The Builder.

VOL. LXXXIII.—No. 3111. SEPTEMBER 20, 1902.

ILLUSTRATIONS.

The Nile Dams :—
Barrage Across the Nile at Asyût: (1) Views of Work Completed and in Progress; (2) Elevation and Section.
Reservoir Works, Aswân: (1) General Plan and Sections; (2) View of Buttress and Sluice.

CONTENTS.

The Nile Dams 241
Notes 245
The British Association 247
Exhibition of Competition Drawings for New Municipal Offices, Crewe 248
The Sanitary Institute Congress 248
Association of Managers of Sewage Disposal Works 251
Illustrations :—
Nile Barrage and Reservoir Works 252
Competitions 252
Sanatoria for Consumptives 52
The Provision and Construction of Sanatoria for Pulmonary Tuberculosis 254
Association of Municipal and County Engineers 255
Applications under the 1894 Building Act 256
The Student's Column.—The Chemistry of Building Materials—II 258
General Building News 259
Sanitary and Engineering News 259
Foreign 260
Miscellaneous 260
Legal :—
The Building Act and Fire Protection 260
An Alleged Dilapidated House 260
Recent Patents 260
Meetings 261
Some Recent Sales of Property 261
Prices Current of Materials 262

The Nile Dams.

LAST month witnessed the completion of the great dam at Aswân, a work that is not only worthy to rank among the highest achievements of modern engineering skill, but must also be classed with the most beneficent undertakings that have ever been inaugurated by men for the help of their fellows. Although we say this work has been completed, we do not mean to imply that it stands alone as a record of what has been accomplished by British energy in connexion with the engineering control of the Nile, nor that it marks the limit of what should, and probably will, be done in the same direction.

On a previous occasion we pointed out how vastly the condition of Lower Egypt has been ameliorated by the repair, or more correctly the completion, of the original barrage, so that it was for the first time made strong enough to perform the duty for which it was designed. In the same article we considered the general nature of the problem presented by the peculiar physical characteristics of Egypt, and while discussing the scope of the great scheme formulated by Mr. Willcocks, then Director-General of Reservoirs to the Egyptian Government, we showed that the dam at Aswân, the barrage at Asyût, and the subsidiary works recommended, could not secure the water supplies necessary for the whole of Egypt. Lower and Middle, and Upper Egypt are now reasonably assured of water in adequate quantity, even during the most unfavourable years, but the Soudan still depends on the variable supplies afforded by natural conditions. Improvement of the Upper Nile, and control of its head waters will, no doubt, come in process of time to afford relief to the provinces lately rescued from the tyranny of barbarism.

Our present object, however, is not to deal with the future, and attention will therefore be confined to the important works already completed. These works are not to be looked upon as isolated units, for the influence of one may be felt by another situated at a distance of hundreds of miles. So we find that the Nile Reservoir at Aswân enables the administration to maintain a higher level at the Barrage in Lower Egypt. Additions 1½ mètres high have been fixed to the 122 upper gates of this well-known structure, and a third winch has been provided for lifting the gates at each branch of the river. Hence the top of the gates when down is now at R.L. 15·50 mètres*, instead of R.L. 14·00 mètres, as before. As all the structural difficulties in connexion with the barrage were caused by the nature of the foundations, it was decided to construct auxiliary weirs below the barrage to reduce the stress, which, of course, would be increased by the greater depth of water held up. The system adopted was a novel one, for which Major Brown, Inspector-General of Irrigation in Lower Egypt, deserves every credit. His object was to minimise the employment of plant and skilled labour, and this was attained, without attempting to dry the bed of the river, by grouting rubble dropped from rafts into a movable timber caisson. Thus solid masonry blocks were formed one after another, extending across the river. In this way both branches of the Nile were dammed, and a navigation lock was provided for each at a cost of about half a million sterling. These works have attracted little attention in this country, but their value to Lower Egypt is not to be overlooked. People are very apt to forget the usefulness of the barrage feeding the six main irrigation canals below Cairo. Even in exceptionally dry seasons, the central canal carries a volume of water one-fourth greater than the Thames in mean flood; two canals on either hand of the two branches of the river carry together one-half more than the Thames; and the Ismailieh Canal is approximately double the size of the Thames. Consequently, as the whole flow of the Nile, during the summer months, is held up and passed into the canals mentioned, the old barrage will always be the most important work connected with the irrigation of Egypt. In addition to improvements at the Barrage, auxiliary works for controlling supplies of water have been carried out, one of the most important being the Ibrahimiyah Canal regulator and lock. The regulator, consisting of nine bays of 5 mètres each, is designed to regulate the supply entering the canal during high floods, so as to prevent danger to the canal itself, or to the different regulators and canals at Deirut.

The most notable work for the advantageous utilisation of water stored up in the great reservoir at Aswân is the newly made barrage across the Nile at Asyût. This extensive work, situated about 250 miles above Cairo, was commenced in the winter of 1898, and completed during the early part of the present year. By the aid of the barrage the perennial irrigation of lands in Middle Egypt and the Fayoum will be improved, and it is estimated that by throwing more water at a higher level into the Ibrahimiyah Canal, the intake of which is immediately below the barrage, fully 300,000 additional acres of land will be brought under irrigation.

A general view of the structure is given in one of our plates, from which it will be seen that in general principle it resembles the barrage at the Delta, though in constructional details there is no similarity. The Asyût barrage is an open weir of 111 bays, each 5 mètres wide; abutment piers 4 mètres thick occur after every ninth opening, the intermediate piers being 2 mètres thick; and the piers are spanned by arches carrying a roadway 4.50 mètres wide. Each opening is provided with two regulating gates, one upper and one lower, each 2.50 mètres high, and these are capable of holding up from 2·50 to 3·00 mètres of water during the summer months. The length of the barrage is 833 mètres (2,750 ft.) and its height from the floor surface to the roadway is 12·50 mètres.

On the western side a lock is provided, 80 mètres long by 16 mètres wide, large enough to permit the passage of any steamer used on the Nile. As the bottom of the river at the site of the barrage consisted of sand, a foundation had to be artificially made upon which the superstructure might be raised, and in order to avoid trouble such as followed the Delta barrage so persistently, the greatest care was bestowed on the design of the foundation. From the drawings we publish it will be observed that the floor is a platform of masonry, which extends from shore to shore. It is 26·50 mètres wide by 3 mètres thick, and is protected up and down by a continuous line of cast-iron grooved and tongued sheet piling, with cemented water-tight joints. This piling extends into the sand bed of the river to a depth of 4 mètres below the under side

* *i.e.*, 15·50 mètres above mean sea-level at Alexandria; "R.L." standing for "Reduced Level."

of the floor, thus cutting off the water, and preventing any undermining action of the kind that proved so disastrous to the Delta barrage.

In order to afford protection against erosion, the river bed is covered for a width of 20 mètres up stream by stone pitching with a bed of clay puddle to check infiltration, and down stream for a similar width by stone pitching with an inverted filter-bed beneath, as a precaution against the removal of sand by springs that might possibly be caused by the head of water above the sluices. The original intention was that the floor should be a combination of concrete and brickwork, and the superstructure entirely of brickwork. As the clay obtainable near the site of the works was found to be unsuitable for brickmaking, it was decided to employ Isawiyah stone instead of bricks. The concrete and masonry of the floor are in cement mortar, and in the walls and piers above floor level, the mortar is of lime and homra.

By reference to the cross-section of the Asyut barrage it will be readily seen that the profile is proportioned suitably for the conditions prevailing both in winter and summer. At the time of high flood the head of water is only 15 centimètres, and in summer it is not more than 3·00 mètres. Hence the barrage requires very little batter on the down-stream face, and its general appearance very much suggests a causeway thrown across the broad expanse of waters. In deciding upon the system to be adopted in the construction of the barrage, the peculiar, and to some extent advantageous, conditions of the river were duly considered. There is only one flood in the year, and within small limits the time of its occurrence can be foretold. Between November and July the state of the Nile is favourable for the execution of below-water work; and the mode of procedure followed was to enclose the site of the work to be done in one season by temporary dams, or "sadds," and then to pump out the water and to carry the work above low Nile level before the end of June. In the season following the upper portion of the masonry could be completed without difficulty. The wisdom of this system will be recognised when it is remembered that the construction of sadds would be unnecessarily expensive, without any counterbalancing advantages, if attempted when the river was at a higher level than that prevailing in November, and that it would not be possible at any reasonable cost to prevent the sadds from being carried away by the flood in July. So the programme was to dam off a portion of the site, to pump the bed of the river dry; then by crowding on the men, to excavate, drive the cast-iron sheet piling, build the masonry floor and piers, and so to get the work up to such a height that the temporary dams would not want rebuilding in the season following.

The work undertaken during the first season was confined to the western side of the river, and consisted in laying the floor forming the foundations of the lock, together with the floor under the site of twenty-nine regulating gate openings—representing about one-quarter of the length of the barrage—and building the lock walls and piers up to a height just above the summer Nile level. Temporary damming was started on December 1, 1898, the sadds including 96,228 cubic mètres of material, and requiring the use of 289,332 sandbags. Pumping was commenced early in February, 1899, the area drained being about 13 acres; and for the purpose of keeping the water down, ten 12-in. pumps and several smaller centrifugal were kept at work until the end of July. Pile-driving, begun on March 2, necessitated the use of 693 lineal mètres of cast-iron piles, weighing more than 1,110 tons, in addition to 12,120 cubic feet of timber piles. Concreting and masonry work were commenced during the first week of May, and continued for a great part of the season, by night as well as day, until August 6, the sadds enclosing the site of the season's work being cut through on the next day. Numerous springs burst up through the sand over practically the whole site of the foundations, but grouting pipes were left over all important springs, and on completion of operations for the season, all cavities formed by the water were grouted up through the pipes. The amount of work performed during the season 1899 may be realised by the statement that the chief items included the following quantities:—Excavation and filling, 359,432 cubic mètres; pitching and clay puddle, 30,147 cubic mètres; concrete and masonry in floor, 28,929 cubic mètres; and masonry above floor level, 8,307 cubic mètres.

A very low flood in 1899 afforded favourable conditions for the early recommencement of preliminary works in the ensuing season, but from soundings taken during and after the flood, it was found that some alterations had taken place in the bed of the river, making the conditions less favourable for work than in the previous season. The deep channel had moved towards the east bank, the sand-bank on the west side had increased in width, closing up the narrow deep channel previously existing near the bank and completely covering with silt the end of the previous year's work on the floor of the barrage. In the second season, sadd-making was commenced on the west side about November 23, and on the east side on December 5. By January 10, new sadds were completed, enclosing a further length of 150 mètres on the west side, and 140 mètres on the east side. Pile driving was commenced at the west side on January 23, and at the east side on February 10, concreting being started about a month later in each case. At the same time, masonry in continuation of the previous season's work was commenced, on the lock wall in the latter part of December, and on the piers about the middle of January. The construction of the new sections of flooring and pier masonry was pushed forward under the highest possible pressure until July 23, when the rising flood burst through a weak point in the sadds, submerging pumps and machinery, and stopping all further work. As the accident occurred only about five days before the date fixed for the termination of work, and as most of the plant was recovered by the aid of divers, the immediate inconvenience was not very serious. The after results were more important, for although the piles on the up and down stream sides of the floor had been driven right across the river, a length of 20 mètres of floor remained wholly unbuilt, and a further length of 140 mètres only partially built. Hence the reconstruction of sadds was inevitable in the next season of work. Bad springs were again encountered over the greater part of the site, all of which required special treatment as before described. During the season the sadds enclosed at various times the whole width of the river bed commencing from the end of the previously completed work. Navigation was carried on through the deep channel on the east side until the end of May, when the channel was closed by joining up the sadds from the west side with a cross sadd enclosing other sadds starting from the east side of the river. A new channel for navigation was provided by cutting the up and down stream sadds, and the new waterway then ran over the finished floor on the east side, two of the masonry piers having been left unbuilt for the purpose. This was the only navigable channel until the end of July, when the rising flood made navigation practicable through the lock and over the tops of several unfinished piers. The extent of the work executed may be realised from examination of the following quantities, which merely relate to the season of 1900:—Sadds, 233,100 cubic mètres; sandbags used on sadds, No. 1,462,000, excavation and filling, 421,870 cubic mètres; dredging, 92,000 cubic mètres; cast iron piles, 1,246 lineal mètres; concrete and masonry in floor, 46,126 cubic mètres; masonry above floor level, 26,320 cubic mètres; pitching and clay puddle, 52,183 cubic mètres. The average daily number of men employed from January to April was about 8,000, but in May and June nearly 13,000 men were engaged daily. Seventeen 12-in. and several smaller centrifugal pumps were constantly at work throughout the season for keeping the water down. The work done during 1900 represented nearly one-half of the whole, and with the amount done in the previous year, three-quarters of the entire structure. The navigation channel, of which we reproduce two photographic views, was practically completed, twenty-seven piers were carried up to their full height, forty-three up to three-quarters their full height, and nineteen up to a little more than summer water level, leaving only twenty-one piers to be built. As we have before said, the barrage was finally finished in the spring of the present year, thus providing the second great regulating valve in the immense conduit that supplies the land of Egypt with water.

The great dam at Aswân is 350 miles above Asyût, and 600 miles above Cairo, and the site is clearly favourable for the establishment of a reservoir such as that which has now become an accomplished fact. Fully forty years ago Sir Samuel Baker suggested the same site, saying—"The great work might be commenced by a single dam above the first cataract at Aswân, at a spot where the river is walled in by granite hills. By raising the level of the Nile 60 ft., obstructions would be buried in the depths of the river, and sluice gates and canals would conduct the shipping up and down stream." In more recent times, the question of barrage was studied in an exhaustive manner by Mr. Willcocks, in accordance with the instructions of Sir William Garstin, Under-Secretary of State. Mr. Willcocks occupied four years in preliminary investigations and in the preparation of alternative schemes relating to the construction of dams at different points along the Nile. He unhesitatingly decided that

the Aswân site was the best, and this opinion was shared by Sir William Garstin, who proposed, however, that the whole question should be referred to an International Committee consisting of Sir Benjamin Baker, Signor Giacomo Torricelli, and M. Auguste Boulé. As a result of this reference, it was decided to construct a dam to hold up water to R.L. 114, across the head of the Aswân Cataract to the north of the Island of Philæ, the Commission being of opinion that this was the only site offering the necessary conditions of solid rock foundations, width of waterway, facility of construction, and sufficient storage capacity. The original plans prepared by Mr. Willcocks were generally described in our previous article, and would have resulted in a reservoir with a storage capacity of 3,700 million cubic mètres of water. Unfortunately, it happened that the scheme involved submersion of the temples on the island of Philæ, and so, finally, the decision was made that fresh designs, incorporating modifications proposed by Sir Benjamin Baker and Signor Torricelli, should be prepared by Mr. Willcocks. It was also settled that the maximum water level should be reduced to R. L. 106, thus giving the reservoir a storage capacity of 1,065 million cubic mètres, much less than one-third the original quantity. The project represented by these designs is the one that has now been carried into execution. As our readers will see from the general plan included in one of our plates, the succession of independent curved dams in the original scheme is replaced by a single dam, stretching in an unbroken line—1¼ miles in length—from shore to shore of the river. No doubt the single dam constitutes a more imposing monumental work than a series of independent dams, at the same time offering better facilities for organisation of the contractor's work and for rapid construction. Further, it is the opinion of Sir Benjamin Baker that the straight dam is better able to resist temperature stresses from extreme heat without cracking. Various other alterations were adopted in the final plans, relating to the dimensions, construction, and arrangement of the sluices, and to the dimensions of the dam itself. After the appointment of Sir Benjamin Baker as consulting engineer, some difficulty arose from the nature of the financial arrangements proposed by the Egyptian Government, but these were smoothed away by the timely help of Sir Ernest Cassel, and in February, 1898, a contract was signed for the execution of the works, the date of completion being fixed as July 1, 1903.

As already stated, the dam is designed to hold up water to a level of 106 mètres above mean sea level, and as the lowest level on the down stream side is about 86 mètres above mean sea level, the maximum head on the dam will not exceed 20 mètres. The reservoir will be filled up every year between December and March, after the flood has passed, and will be discharged during May, June, and July, when the normal supply of water is small and the need of the cultivator is great. At that season of the year the flow of water contributed by the reservoir will be equal to a river double the size of the Thames in mean annual flood condition. For proper regulation of the flow the dam is pierced by 140 under sluices, each of 14 square mètres area, and by forty upper sluices, each of 7 square mètres area. During flood time the sluices will be kept fully open, so that the red water may pass freely through without deposition of the fertilising silt. After the flood, when the water has become clear, the sluices will be gradually closed. In ordinary years the reservoir will be filled by the beginning of March, when some of the upper sluices will be opened to permit the discharge of surplus water, the level in the reservoir being maintained at R.L. 106. In May, when an increased quantity of water is demanded for summer crops, the sluices will be opened so as to supplement the supply in the river, and the reservoir will be discharged until about July 1, when all the sluices will be fully opened to pass the waters of the annual flood.

Bearing in mind the immense volume of water stored, it may seem that its judicious addition to the natural summer flow should abundantly satisfy all needs. It is true that the supply will be reasonably assured, and that freedom from water famine may be anticipated even when the supply is most deficient. But the supply will not be abundant. Water must still be husbanded and doled out, as rations are to a shipwrecked crew, all receiving a fair though strictly limited share at appointed times. It is a revelation to the average Englishman to read the elaborate regulations that fence round the use of water in Egypt. The most elaborate systems of rotation are drawn up by Government, so that crops in different districts may be watered at intervals, and even the drawing of water from the channels in buckets is under strict supervision. We do not propose to enter into details concerning the problem of irrigation in Egypt, but those to whom they are familiar will be able to appreciate the regret felt that reasons existed for curtailment of the storage capacity of the reservoir at Aswân.

One of our plates gives a general idea of the dam, and the country in which it is situated. The total length of the structure is about 2,000 mètres, and the height from the deepest part of the foundations is about 40 mètres. Where the dam is solid the width at the top is 5 mètres, but where pierced for sluices, an additional width of 2 mètres becomes necessary, and the width of the base at the deepest part is 25 mètres. The masonry of the dam is of local granite set in British Portland cement mortar. The interior masonry is of rubble granite set in 4 to 1 cement mortar, which forms about 40 per cent. of the whole, while the facing on the up and down stream sides is squared granite rubble in 2 to 1 cement mortar, pointed with mortar of similar strength. Some of the sluice openings are lined with finely dressed ashlar, and others with cast iron. The foundation course is also laid in 2 to 1 cement mortar. Commencing at the Thirmosia Channel on the eastern side, the sluices extend at regular intervals right across the river to the western bank, where a navigation channel has been cut, including a "ladder" of four locks, each 70 mètres long by 9·50 mètres wide. The five lock gates were designed by Mr. Wilfred Stokes, engineer to Messrs. Ransomes & Rapier, and vary in height up to over 18 mètres. They are hung from the top on rollers, and when opened or shut are moved on sliding ways. This method was adopted for safety, as over 1,000 million tons of water are stored behind the gates, and each of the two upper gates is of sufficient strength to hold up the whole of the water. A close examination of the general plan will reveal the variations of width at the base of the dam, and the down-stream buttresses separating the groups of sluices. Speaking in very general terms, the foundations vary in depth according to the surface level of the site, but there is really no uniform relation between the two lines, owing to the variable quality of the granite outcrop at the site of the dam.

Although the preliminary investigations of Mr. Willcocks and other Government engineers extended over a considerable period, there were financial and other reasons preventing the sinking of trial borings to ascertain the actual character of the granite, but appearances led to the conclusion that sound rock would be found everywhere at a convenient level. On the commencement of operations, however, it was found to be rotten at several points to a considerable depth, and to contain schistous micaceous masses of very friable nature, which made it absolutely necessary that the foundations should be carried down much deeper than was originally contemplated, or provided for in the contract. The serious trouble caused by this unexpected state of things will be realised from the following figures, which show the approximate depth of the foundations at some of the principal channels of the river:—East Channel, R.L., 85; Thirmosia Channel, R.L., 87; Bab-el-Kebir, R.L., 70.25; Bab-el-Sughaiyar, R.L., 76.70; West Channel, R.L., 74.49. Bearing in mind the normal thickness of the dam and the predetermined batter, as shown on the cross sections, it is clear that every mètre of unexpected depth meant a large increase in the quantity of the masonry, to say nothing of the cost involved by additional foundation work. The sluices are closed by steel gates, designed by Mr. Wilfred Stokes. Of the gates, 130 are on the "Stoney" principle, with rollers suspended in frames, so that the gates may be easily worked when subject to heavy pressure. The larger of these, although weighing 14 tons, can be moved by hand under a head of water giving a pressure of 450 tons against the gate. The remaining fifty gates move on sliding surfaces. One of our plates shows a buttress and sluice opening on the down-stream side of the dam, and the view is further interesting owing to the fact that, besides other well-known men, it includes what we believe is the last photograph taken of the late Cecil Rhodes.

Upon the signature of the contract, the general contractors, Sir John Aird & Co., with Messrs. Ransomes & Rapier as sub-contractors for the steelwork, immediately took possession of the site and of as much adjoining desert as they thought necessary for the construction of railways, dwellings, offices, mechanical workshops, stores, and hospitals, and for the installation of sanitary arrangements, water supplies, and other conveniences incidental to the establishment of a busy industrial centre in the midst of a wild desert. Preliminary works were started in April, 1898, and while the necessary plant and materials were being accumulated, a commencement was made with excavation on the east end of the dam and in the navigation channel. Before the

end of the year thousands of native labourers and hundreds of Italian granite masons were hard at work, with the result that 21,399 cubic mètres of excavation was performed before the end of the season. Although the actual amount of permanent work executed during the first year's operations was comparatively small, much valuable information was gained by observations and surveys of the different channels and the surrounding country. The foundation-stone of the dam was laid on February 12, 1899, by the Duke of Connaught, and after this pleasant function some of the most difficult work in the whole undertaking was seriously commenced, namely, the preparations necessary for the formation of foundations in the boiling channels of the Aswân Cataract. With reference to this part of the undertaking Sir Benjamin Baker wrote:—"It would not be too much to say that any practical man standing on the verge of one of the cataract channels, hearing and seeing the apparently irresistible torrents of foaming water thundering down, would regard the putting in of foundations to a depth of 40 ft. below the bed of the cataract, in the short season available each year, as an appalling undertaking." The severity of the task was aggravated by the previously mentioned unreliable character of the rock. Many plans were discussed by the engineers and contractors for making foundations in the roaring cataracts, and ultimately it was decided that the best method would be to construct sadds across the channels, up-stream and down-stream of the site of the dam, so that the area between might be pumped dry. Even with the comparatively small flow of water during the springtime, a depth of at least 30 ft., and a velocity of some fifteen miles an hour, had to be reckoned with, and it will therefore be realised that the sadds had necessarily to be of the strongest possible construction. Besides, it must be remembered that they had also to resist displacement by the Nile flood. So it was settled that one of the sadds in each channel should be built of stone, and on the down-stream side of the site. The idea was to get these barriers finished before high Nile, so as to obtain still water above them early in the following season, in order that sand-bag sadds could be commenced on the up-stream side immediately the water-level fell to the top of the stone barriers. Three of the five deep channels of the river were selected for the first attempt:—the Bab-el-Kebir, Bab-el-Harum, and Bab-el-Sughaiyar. The fall through these for a distance of about 100 mètres on either side of the axis of the dam was approximately 3 mètres at low Nile. To form the sadds, stones varying in weight up to about four tons were dropped one by one into the cataracts by means of cranes, but sometimes the largest stones were carried away by the rush of the water. In some cases wire nets full of stone were tipped in, and when the net did not move after falling, this method proved effective. But if movement took place, the netting was generally cut and the stones fell out. Great difficulty was experienced in closing the sadd in the Bab-el-Sughaiyar, but the engineers made up their minds not to be beaten. So they cheerfully ran in bodily large railway wagons filled with stone in wire nets, and tied round with steel ropes. Each wagon with its contents weighed 25 tons, and formed a toe against which large stones were successfully lodged. At last the pertinacity of the engineers was rewarded by the appearance of the expected dam above the surface of the waters. Finally, the three sadds were finished in the month of July, 1899, to a level about 5 mètres below high Nile, and when the flood descended they stood fast and were not moved. As a general rule, the stone sadds were 7 mètres wide on top, with slopes of about one to one; the greatest depth was 15 mètres, and the R.L. of the top was 93·50.

Simultaneously with the work we have briefly described, extensive operations were carried on at other parts of the site. During the year excavation was completed for a length of 685 mètres from the east end of the dam, and for a length of 55 mètres in the Mohammed Ali Island, while excavation was in progress elsewhere over an aggregate length of 600 mètres, the total quantity of excavation for the year being 100,212 cubic mètres, the total quantity of masonry laid during the year was 74,703 cubic mètres. In the month of November the water level fell low enough to allow the sand-bag sadds to be commenced, and the three channels mentioned were completely closed by the end of 1899. The sand-bag sadds measured 5 mètres wide on top, with slopes of about 1½ to 1, and the greatest depth was 17 mètres, the top being kept to R. L. 93·50. These sadds were made staunch by throwing sand and small fragments of stone on the up-stream side, where the slope eventually became 2 to 1.

A consultation was held in October for the purpose of settling a programme for further operations, and it was decided that, if possible, the foundations of the dam in the three closed channels should be got in during the year. In view of the unusually low flood of 1899, and the subsequent rapid fall of the river, it appeared likely that the foundations in the central channel might be laid in addition to those in the other channels mentioned. Consequently, the sadds were continued across this channel, with the result that it was closed by the end of February, and the entire flow of the river was diverted to the west channel. The effect of this treatment proved to be eminently satisfactory, for the bed of the river below the line of sadds was left dry, except in a few places where small sand or clay sadds sufficed to hold back the water. Even before the construction of the up-stream sadds, the stone barriers exercised an unexpected influence, checking the flow sufficiently to cause a difference of over 3 mètres in the level of the water; but when the up-stream sadds were made, the average difference was about 6 mètres, the maximum being 10 mètres; so the down-stream subsidiary sadds were of comparatively small dimensions. Sir Benjamin Baker says that the most exciting time in the whole stage of the operations was at the commencement of pumping, for no one could predict whether it would be possible to dry the river-bed, or whether the water would pour through the fissured rock in overwhelming volumes. A large number of 12-in. centrifugal pumps was held in readiness, so that very ample power might be available; but, happily, the sadds were found to be remarkably tight. Six 12-in. pumps were started in the Bab-el-Kebir, and the channel was pumped dry the same day, after which one of the pumps, working about quarter time, served to deal with all leakage. One 6-in. pump removed all the water from the Bab-el-Harum, and only two 6-in. pumps were required in the Bab-el-Sughaiyar. This easy solution of the problem made it possible for excavation in the three channels to be put in hand by the end of January. On February 28 everything was ready for pumping out the central channel, and the water was rapidly removed by a 12-in. pump, leakage being subsequently dealt with by one 8-in. pump.

Having surmounted preliminary difficulties, the contractors had excavation in full swing along all four channels by the first week of March, 1900, by which time masonry had been commenced in the Bab-el-Harum. The next trouble to be got through was the unsound rock, which was particularly bad in the Bab-el-Kebir and the Bab-el-Sughaiyar. March, April, and a good part of May went by before rock of reliable quality was reached. As the time remaining before the occurrence of the Nile flood was then exceedingly short, as compared with the large amount of work to be done, it was feared that the expense and delay of rebuilding sadds would be necessary in the next season. In the Bab-el-Kebir the foundation level was 11½ mètres below the level shown in the contract drawings, and a period of only ten weeks was available for building the masonry to a height of 24 mètres across a channel about 65 mètres wide. At the Central Channel unsound rock was found in so many places, that masonry could not be got in before the beginning of May. Things were a little better on Mohammed Ali Island, as some excavation had been done during the previous year. In June a tremendous effort was made to push forward the masonry. Work was carried on every day of the week, and in the Bab-el-Kebir it was continued through the night by the aid of electric light. Masons to the number of 353 were employed daily, and during thirty days no less than 45,000 cubic mètres of stone were laid. Nightwork was stopped after the end of June, for it was then evident that everything could be finished in good time. On July 12 the sadd in the central channel was cut to relieve pressure on the sadds in the other channels; and a week or two later the remaining sadds were opened, so that the river flowed freely through the sluices. As water did not reach to the top of the masonry, work was continued until the first week in August. The flood then rose above the masonry except on high ground at the east bank, where building was continued. Excavation in the navigation channel was nearly finished during the same year, and masonry was commenced in the month of June. After the flood had subsided, masonry work was resumed in the channels, and all necessary preparations were made for closing the West Channel, the only portion of the site in which the foundations had not been laid. So ended the work of the most momentous year in the history of the undertaking. At that period 577,515 cubic mètres of excavation and 239,468 cubic mètres of masonry were complete, representing respectively 78 per cent. and 45 per cent. of the whole.

Subsequent operations offered much less difficulty, but no efforts were spared by the engineers, contractors, and sub-contractors to push forward the work, and the very unusual result was achieved of completing

the great barrier considerably earlier than the date specified in the contract.

There now remains to be dealt with a consequence of the immense lake formed at Aswân, which is of special interest to our readers. We refer to the partial submersion of the island of Philæ during the three months in each year when the new reservoir will be full. Although at such times the buildings on the island will not be entirely covered, the highest water-level will rise to the floors of the Temple of Isis; the nilometer will be totally submerged, as also will the Temple of Hathor and the Diocletian arch. When the water is at its maximum height little more than the temple pylons and a few of the loftier ruins will be visible on the face of the lake. Much as we regret these things, the time has gone by for further expostulation, and the fact that Egypt must gain far more than the rest of the world will lose must be our consolation. One practical point in connexion with this part of our subject deserves notice. As our readers are probably aware, the temples of Philæ are partly founded on loose silt and mud, and the saturation of dry material of the kind would undoubtedly cause settlement, if not the ultimate collapse, of the ruins. It is therefore satisfactory to learn that measures have been taken to safeguard the more important buildings by supporting all the important parts on steel girders, or underpinning them down to rock, or where this has been impossible to the present saturation level. Considering the shattered condition of the columns and entablatures, the friability of the stone, and the unstable nature of the foundation, the process of underpinning cannot have been other than a peculiarly arduous and anxious task. One of our illustrations is reproduced from a photograph taken during the progress of this work, which we are pleased to be able to say was performed to the satisfaction of Sir Benjamin Baker, and of Dr. Ball, who had charge of the works at Philæ.

Sir Benjamin Baker, to whom we are indebted for the photographs and drawings illustrating this article, says it would be invidious to single out for special acknowledgment the services of any members of a staff where all have worked with so much enthusiasm for the accomplishment of the great work projected and patiently persisted in by Lord Cromer and his well-tried lieutenant, Sir William Garstin. That the same spirit also animated the general contractors and subcontractors is amply evidenced by the fact that a largely increased amount of work has been completed in less than the contract time, to the entire satisfaction of every one concerned.

NOTES.

Municipal Trading.

THE British Association last week had under discussion the subject of municipal trading; a question of national importance to which we have frequently drawn attention. The discussion as reported seems not to have been prolonged, and we regret that more attention could not be given to this subject. The Hon. R. P. Porter, Director of the Eleventh United States Census Paper, who read the paper, seemed on the whole averse to municipal trading; but Sir B. Leech, speaking for the important English centre Manchester, expressed unlimited approval. The objections raised by Mr. Porter to the system were the injurious effect on other work directly within the sphere of operations, the tendency it created to cause municipalities to neglect their unproductive undertakings (which we may point out means the functions they were called into being to perform), the tendency to discourage private enterprise and development, the ill-feeling engendered when the tax-payer was competing with himself, the difficulty of securing an equality of burdens on the taxpayers, and the difficulty of drawing a line within which municipal trading should be restricted. These objections are weighty enough, but hardly seem exhaustive. Trading municipalities are not affected by the laws of supply and demand; they carry on undertakings at little profit or even at a loss, and pay wages independently of loss or profit, which unreasonably affects the scale of wages and hours of labour; in undertakings they cannot engage in, and on which the foreign trade, and consequently the prosperity, of this country depends; and one of the reasons urged in their favour, viz., that they are able to borrow money at less interest than private companies, directly tends to encourage this. The second point put forward in support of municipal trading by Sir B. Leech appears also to us to be a false one, as he advocated any system which necessitated breaking up the streets being placed within their operations. This can hardly be for the public advantage when a municipality is immediately interested in securing profits, as the direct gain becomes the one consideration, and not the public convenience. Lastly, we may point out that if municipalities are to become trading companies, legislation is very necessary. Having regard to the public duties such corporations were alone created to carry out, the law has protected them in certain ways, giving them protection on the analogy of the advantages enjoyed by Government undertakings; but such protection becomes the cause of injustice when it is applied to the commercial undertakings of a municipality. The conversion of the taxpayers into quasi-shareholders in companies with unlimited liability, and practically unlimited borrowing powers, is a startling innovation, and one likely to be most prejudicial to the commercial prosperity of this country.

The Loudwater Tunnel Collapse.

COMPARATIVELY little useful information is afforded by the proceedings at the inquest into the Loudwater tunnel accident. From the evidence given, it appears that the tunnel, in course of excavation through the chalk, was shored up as the work proceeded, no part of the roof being left without support. Yet, in spite of this, the roof of the tunnel fell in suddenly, the timber supports having either slipped out of place, or broken under the unexpected weight of a loosened mass. No particulars are given as to the nature and strength of the timbering, and no expert witnesses were called to speak as to the engineering aspects of the case. It transpired, however, that blasting had been practised, thus presumably showing the chalk to be of the quality locally known as "rock." Consequently the inference might not unreasonably be drawn that the strength of the shoring was proportioned suitably for holding up comparatively small masses of material, and that considerable reliance was placed upon the self-sustaining nature of the chalk formation. It seems that a very extensive movement took place, for a depression was afterwards observed at the top of the hill. No evidence was forthcoming to show whether any connexion existed between the collapse and the presence of water observed in the tunnel, but it appears that gravel had been found in the chalk formation. Hence it is extremely likely that water may have contributed to the settlement of so large a mass of the chalk as to crush the timber supports. The sub-contractor stated that the fallen material was mostly gravel, and expressed the opinion that if it had been chalk all over the roof the accident would not have happened. This appears to be tantamount to admitting that the timbering was strong enough to support rock, but not to hold up looser material. No railway engineer and no contractor's engineer has appeared on the scene to tell the public just those technical details which should be known. Therefore, every one is left to draw his own conclusions, and we cannot avoid the inference that the precautions taken were inadequate from an engineering standpoint, although we fully admit that this view by no means implies culpable negligence on the part of the contractors or of their employees.

The Education of Engineers.

A CHARACTERISTIC address, delivered by Professor Perry, at the meeting of the British Association, expresses some views on the educational requirements of the engineer which are worthy of note. The subject is one upon which a great deal has been said of late, and of which the importance is becoming recognised even by such ultra-conservative bodies as the older universities. Professor Perry holds extremely practical opinions on the question, and these he frequently expounds in vigorous and picturesque language. In his latest address, it is said that our methods of education are wrong, including, as they do, "the ordinary abominable system of mathematical study"; the teaching of mathematics, physics, and chemistry "in water-tight compartments as if they had no connexion with one another"; the undue preferment of Latin; the neglect of English; and the suppression of independent thought. There is considerable justification for this criticism, even after making reasonable allowance for possible exaggeration, but the remedy proposed by Professor Perry, of "scrapping" our present system so as to start afresh on a consistent and simple plan, is one that cannot be taken seriously Of course, in any old-established country there are many things and institutions that earnest reformers would like to see "scrapped." But it would be inconvenient to apply the remedy without the most careful preparation. For instance, a city full of tortuous streets and undesirable slums could not be wiped off the face of the earth until a new city, or at least temporary habitations, had been provided for the populace. Similarly the present educational edifice, however rambling it may be, cannot be destroyed until a new one has been drawn up and got into action. Novelties in education, as in all other things, must be introduced gradually, and extended when results prove them to be good. As a matter of fact, Professor Perry and those who sympathise with his aims are already working

in this very way, to which they will be wise to adhere.

Radio-Activity Universally Diffused.

PROFESSOR J. J. THOMSON gave a very remarkable lecture on "Becquerel Rays and Radio-Activity," last week to the British Association audience at Belfast. The discoveries made in this department of physical research have recently been very numerous, and the lecturer could refer to many phenomena which strengthened the foundations of his corpuscular theory. It will be remembered that when he stated some five years ago that cathode rays were formed by streams of material corpuscles very much smaller than the hydrogen atom, and moving with a velocity of thousands of miles a second, nearly every one thought that this was incredible. Now we look upon this as almost a scientific commonplace. Substances of the most ordinary appearance are continually emitting streams of material particles which travel with a velocity comparable to that of light. These streams make sensitive screens brilliantly fluoresce in the dark; they show the bones in the hand; if sufficiently intense they produce very severe burns on the human body, and they are always emitting streams of negatively electrified particles into space with a velocity of about 100,000 miles per second. But although the radio-activity of substances like radium and thorium is so intense, it would require thousands of years before the loss of weight would be appreciable on a chemical balance. The energy that must be stored up in these substances is exceedingly great, and the lecturer gave some striking illustrations. A notable recent discovery is that substances can be made radio-active by hanging them in the open air and charging them negatively. By this means a piece of paper can be made as radio-active as a piece of metal, but it loses its activity after a few hours. Since the earth is negatively electrified, all pointed objects like the leaves and spines of trees acquire this kind of activity. In fact, it is now believed that there is hardly a patch of ground on the earth's surface which is not continually emitting these rays—rays which have only recently been discovered by the help of the most elaborate apparatus.

Electric Traction on American Canals.

EXPERIMENTS on the Erie Canal, although not absolutely satisfactory, have sufficiently demonstrated the benefits that may be ultimately expected from the introduction of electric traction on canals. It seems to be quite clear that the system should show much greater efficiency than haulage by horses or mules, and even than steam-propelled canal boats, especially when the natural advantages of America are borne in mind. The new power-house at Niagara Falls, when completed, will add 50,000 h.-p. to the present establishment of the Niagara Falls Power Co., giving a total of 100,000 h.-p. for transmission and distribution, with a further possibility of 100,000 h.-p. from the same tunnel as a tail race. The power canal passing through the city from Niagara Falls renders available an additional supply of 10,000 h.-p., while the completion of the plant in progress for the Canadian Power Co. will add 200,000 h.-p. more. Altogether 500,000 h.-p. is already in prospect for electrical power transmission in the neighbourhood of Niagara Falls, Western New York, and Canada. Consequently it is not unlikely that the Erie Canal, in the United States, and the Welland Canal, in Canada, will become large users of electricity for canal haulage. This agency would undoubtedly increase the carrying capacity of the waterways in question, and so encourage a considerable augmentation of ore and coal traffic from the mining districts bordering the Great Lakes.

Kidsgrove Urban District.

THIS district seems to have been for a long time in a very unsatisfactory state. Dr. Wilfred Fletcher's report to the Local Government Board states that though most of the houses are drained to sewers, many of these sewers are very old, there is no complete plan of the sewerage system, no adequate ventilation, and no arrangement for flushing. There are very few water-closets in the district. Privies with cesspits, the latter frequently beneath the floors of the privies, are in general use. In some cases the cesspit is covered outside the privy by a stone flag, which is raised for purposes of removing the filth; to other cesspits access for cleansing purposes is obtained from within the privy by removing the seat, often so constructed as to be usable by two persons at one time. The sides of the cesspits are constructed of brickwork, frequently uncemented; the bottoms in some instances are not bricked. They are emptied, however, by the Local Authority, on notice being given by card, which is better than leaving it to private contractors. The district seems to have suffered first from an incompetent Inspector of Nuisances (dismissed two or three years ago at the instance of the Local Government Board), and then from the resignation of a competent man, who found the duties incompatible with attention to his private practice. Now another Inspector has been appointed at a salary which must leave him to depend largely on private practice, so that probably the same difficulty will recur.

Disregarded Signals on Railways.

AN extraordinary instance of the way in which the most elaborate precautionary measures may be rendered entirely futile was brought to light in the course of an inquest held last week at Hastings. The driver of a train which had run over and killed a platelayer in the Bopeep Tunnel admitted that, although the steam from the engine obscured the signals, he ran past them—in spite of the Company's rule that trains should be stopped when the signals are uncertain—"taking it for granted that they were favourable!" The unfortunate platelayer, who had stepped out of the way of a train travelling in the opposite direction, was justified in "taking it for granted," that he ran no risk in so doing, as only one train is allowed in this tunnel at a time—a rule which should have afforded him complete protection. It is quite conceivable that the signals might have been against the driver on account of some obstruction on his line in the tunnel, and it is clear that no amount of care in the framing of rules provides absolute immunity from danger. These, fortunately, rare cases go to remind us that we are, after all, dependent upon the correct working of the "human machine."

Carpenters' Company Training Schools.

THE Report of the judges on the work done at the Trades' Training Schools in Great Titchfield-street, in connexion with the Carpenters' Company, shows that a great deal of important practical training is being given in these schools, with generally good results. The Report is illustrated by photographs of various specimens of the work done during the session 1901-2. Among these, the model in wood of a compartment of a fan vault appears very good, also the specimen of wood-carving, though in the Report the general work of this class is said to be rather disappointing. The Painter-Stainers' Company is congratulated on the improvement shown in this department of the school, and the example of a wall-paper design given is very good. The Bricklayers' class also is well spoken of, and appears to be doing good work. We would suggest that in future Reports the name of the student and of the class should be given under each illustration

The Photographic Salon.

THE Exhibition of the Photographic Salon, now open at the Dudley Gallery, professes to represent "examples of contemporary photography which give evidence of personal artistic feeling and motive, apart from the purely scientific and technical considerations with which it was felt that the pictorial possibilities of photography had too long been confused." We have often expressed the opinion that the idea of elevating photography to the rank of a fine art is for the most part a delusion; it seems in many cases to resolve itself into an effort to render a photograph, by losing focus, employing very rough paper, and other contrivances, as like a monochrome washed drawing as possible. But the personal element of touch and handling which gives interest to a water-colour drawing can only be attained in a photograph by subsequent manipulation, and it then ceases to be in a true sense a photograph. We can hardly believe, for instance, that "The Incoming Tide" (198) represents the photographed forms of breaking waves; lights have surely been worked into it for the surf, in part at all events. Nevertheless, the Photographic Salon of this year includes works of which the interest mainly arises from the choice of view and arrangement of composition by the photographer. Examples of this are Mr. Henneberg's two photographs, "Villa Adriana" (13) and "Villa Torlonia" (149), in both of which the effect consists in the view of a building in light seen through an avenue of dark masses of trees. In "The Return of the Flock" (123) Mr. Charles Job has contrived to get a kind of realised Mauve picture, seizing also a moment when the light in the evening sky was just what was wanted for pictorial effect; the sheep are not as parallel in their movement as Mauve generally shows them—perhaps the difference between nature and art. In "A Silenced Highway" (21) Mr. Burkinshaw has got a beautiful snow effect. Architectural subjects, as usual in photographic exhibitions, receive much less attention than they should, considering how well such subjects lend themselves to photography; but there are one or two admirable ones; notably "Ely Cathedral" (8), the interior seen "through a chantry door," which is

exceedingly delicate and precise in its representation of detail, while avoiding any mechanical hardness of effect; and Mr. Fischer's little street scene, "Minuit" (17), is a most successful example of a photograph apparently taken by the light of a street lamp, which we had hardly supposed to be possible. In the class of subjects in which an ideal treatment of figures is aimed at—rarely successful, since figures in pictures owe so much to the painter—Mr. Blount has certainly succeeded better than usual in his "Lady of Shalott" (6), in which there is really a poetry of expression and composition. Mr. Steichen studies nude figures, with which much might be done in photography but for the fact that the photographer is necessarily restricted by considerations of decorum which a painter can evade, and so is reduced, as in some of these cases, to leaving the figure in a kind of mist; but his "Reflections" (212), a figure seated on the ground with her back to the spectator, is a good picture; so is Mr. Dyer's partially draped figure, "The Model" (145). M. Puyo's "Etude pour un Geste" (157) is an amusing example of the plain prose of the nude, with the pinched-in waist of a figure accustomed to tight lacing; an example which shows again how much we owe to the painter in many an idealised nude figure. Mr. Steichen's portrait of M. Bartholomé, the sculptor of the "Monument aux Morts,' leaning against a fluted column, is finely composed and very effective. As a whole, there is much to interest in the exhibition, though, as observed, it does not raise photography to the level of a fine art.

THE BRITISH ASSOCIATION.

THE annual meeting of the British Association, held this year at Belfast, although largely attended, cannot be said to have been a great success from a scientific standpoint. The fact is that the innumerable societies now formed by specialists take away from the Association that originality that it once possessed; and the impatience which scientists now exhibit to bring to light any little discovery they have made makes it impossible for the Association meeting to do more than air a few scientific topics relating to the *locale* of the meeting, or to mere generalities mostly of a discursive character. The time was when, for instance, Sir Roderick Murchison would come specially from the confines of Siberia to attend the meeting to give the members the results of his recent investigations, or Sedgwick would return from Cambria and lecture; but these things are all changed, and in their place we have, this year, the melancholy spectacle of teachers teaching teachers how to teach—for that is the sum and substance of the principal orations.

The fact of the matter is that the principal grievances aired at this Belfast meeting are not born of experience at all; they are too theoretical. It is perfectly correct on the part of Presidents to extol the German methods of teaching certain subjects, but how many of those presidents understand German, and have, for themselves, followed up the effects of that teaching? The pursuit of a science, no matter of what kind, must be carried out on general lines first of all; otherwise the mind of the student becomes too contracted and incapable of appreciating anything outside his particular sphere. We suppose the Education Bill has had something to do with this epidemic on the part of presidents, but the less they keep away from politics and the more they deal with purely scientific subjects, the better they will serve the purposes for which the Association was formed. We hear a great deal about "economics." A school has recently been founded in London for economics. What is the object of it? It would be a difficult matter for even the founders of it, eminent as they are, to really give a clear answer to that question. Yet matters of this sort have occupied more attention this year than any other, except, perhaps, lantern entertainments and excursions to tourists' resorts. A considerable amount of money is given every year by the Treasury to the Association for the assistance of those who are deserving of help in the prosecution of their researches in the different departments of science. We do not begrudge it, but we think that if the money were more evenly distributed over the "different branches of science," it would be all the better, and it would certainly be refreshing to find that the recipients of the Government bounty did not, on the whole, regard the grants as domestic expenses.

The *raison d'être* of the British Association is to give an epitome of the past year's work, and to encourage further research; it does not fulfil that ideal in its entirety. It has degenerated to a mere tourist's outing with a few scientific observations thrown in during the excursion. That has long been known, but it is getting worse and worse. However, amid all this incongruity we do find a little leaven. The President's address, for instance, is a conspicuous example of it. Professor Dewar did not, however, especially deal with his favourite subject, and he failed to altogether please his audience in consequence. References to the progress of Belfast, and to the late Lord Dufferin, serve their purpose no doubt, but we should have thought that "Tyndall and evolution" was worn out. The endowment of education seems to have been misunderstood by the President. He said that in these days of "munificent benefaction to science and education it may be doubted if we take into account the change of the value of money, the enormous increase of population, &c." Education has so long been left to take care of itself that it is impossible that private benefaction can do anything worthy of it, and, since education is so much governed by the man in the street, we doubt whether the higher branches of it will be able to be satisfactorily conducted. Again, the payment to professors is absurdly inadequate; 100*l.* a year might do very well for a City clerk, but it is of little use to the professor at a university, who must either have private means, or a capacity for doing some other work. The London University, as Professor Dewar knows, is unable to pay anything at all to the professors attached to it, and unless "munificent benefaction" is to be created on a much greater scale than hitherto, other means must be adopted to bring about anything approaching real progress. A demand is made that professors must do some original work, but no fund is available to enable them to do so, much as they would like to pursue their work unhampered by pecuniary responsibilities. It is much easier to get money for elementary education, especially now that different local bodies vie with each other as to who shall take charge of this or that establishment.

Turning to the addresses of the presidents of the various sections, Professor John Purser, of the Mathematical and Physical Science section, selected for his topic a historical sketch of the Irish school of mathematics. The sketch was restricted to those who founded the school. In the section devoted to chemistry, the President, Professor Edward Divers, dwelt on the "Atomic Theory without Hypothesis." He remarked that Dalton, instead of being the founder of the chemistry of to-day, was little more than the discover of the law of multiple proportions. When the atomic theory is expounded in the usual way, it is commonly and correctly stated that, on the assumption that substances consist of minute indivisible particles having weights or masses bearing ratios of the combining numbers assigned to them, the laws of chemical combination by weight necessarily follow, and are thereby explained.

In the Geology section, the President, General McMahon, discoursed on "Some Aspects of Rock Metamorphism," having special reference to certain parts of the Himalayas with which he is well acquainted. The address was of a rather commonplace character, like most of the other communications to the geology section. After the address, Professor Grenville Cole delivered a lecture on the geology of the country in the neighbourhood of Belfast, which had no pretence to originality. Mr. Joseph Wright contributed a paper on the "Marine Fauna of the Boulder Clay," which appears to be an unfortunate title, seeing that the author dealt almost exclusively with the foraminifera found, though the paper is a substantial contribution to our knowledge concerning the more recent deposits. Mr. R. J. Ussher read the report of the committee appointed to explore Irish caves. The report dealt with the exploration of the Kesh caves in county Sligo. Mr. Horace Woodward read a short paper on the "Occurrence of Bagshot Beds at Combe Pyne, near Lyme Regis." His observations were based on certain cuttings on the new railway between Axminster and Lyme Regis in the neighbourhood of Combe Pyne Hill. Beds of fine white sand, white pipe-clay, and white, red, and mottled stony clays, with much rough flint and chert gravel, have been found.

Professor G. B. Howse spoke to the zoologists, in his presidential address, on the "Morphological Method and its progress." It was a retrospect of the achievements of zoology since the Association last met in Belfast. The President of the Section of Geography, Colonel Sir Thomas Holdich, took as his theme the importance of thorough geographical surveys. In the section devoted to Economical Science and Statistics Mr. Edwin Cannan, the President, told his audience that the teaching and study of the theory of economics is a thing of very great practical utility.

The engineers were addressed by their President, Professor John Perry, and to his remarks we make some reference under the heading of "Notes" on another page. In the Economic Science section, after the President's address, the Rev. Dr. Cunningham read a paper on the "Localisation of Industry," in which he remarked that the conditions which have led to the concentration of a given trade are partly physical conditions, as in the case of coal mining, or of favourable circumstances for growing some crop; but the transport of material is so easy that industry is less bound than was formerly the case to the area where it can be obtained.

After the presidential address the Engineering section was occupied in hearing a paper by Mr. H. A. Humphrey on "Recent Progress in Large Gas-engines." In the course of his lecture the author traced the development of gas-engines and pointed out the remarkable manner in which the size and power of this type of prime mover has grown, especially within the last few years; a development which has few parallels in the history of engineering enterprise. Gas-engines of 1,200 and 1,500 horse-power were already working, and others of 2,000 to 4,000 horse-power were being constructed. At the conclusion of the reading of the paper the members adjourned to visit the Belfast harbour works.

The anthropologists listened to the address of Dr. A. C. Haddon on "Totemism," and he had to explain the meaning of the word before the anthropologists could understand what he was talking about—at least, he did so. "Spirit helpers," "daimons," and "guardian spirits" were called to give evidence during the course of the address, which proved to be very interesting, if it was not scientific. Professor Cunningham read a paper in the same section on "Cornelius Magrath," who was a giant 7 ft. 5 in. in height, and born in Tipperary in the year 1736. The skeleton of the giant was exhibited before the meeting to show that there was no deception.

Professor Halliburton, President of the Physiology section, took as his subject the present position of chemical physiology. He claimed that this branch of science is rapidly becoming an exact science, and pointed out the increasing importance attributed by physiologists to the study of inorganic chemistry and their applications to doctrines of physical chemistry, such as ionisation, to the explanation of physiological phenomena. He emphasised the necessity of bold experiment and of bold theorising from the data obtained, and illustrated his position by reference to the work of Pavlow on digestion and of Ehrlich on immunity.

Professor J. Reynolds Green occupied the chair of the Botany section, and chose for his subject the field of vegetable physiology. The Educational Science section had for President Professor Henry Armstrong.

Very few of the papers read before the sections are of interest to our readers. The members did very little on Saturday, for none of the sections sat; they preferred to roam about the vicinity of Belfast and to attend numerous social festivities. In the evening a lecture was given by Professor Miall to work-

ing men on "Gnats and Mosquitoes." On Monday garden parties were the order of the day, except in a few sections. The geologists were told something about the geological structure of Ireland, which most of them must have known before; but the day was productive if only on account of the lively discussion on a paper by Mr. Barrow on the prolongation of the highland border rocks into county Tyrone. The engineers were enlightened by Mr. J. E. Kingsbury respecting the "Future of the Telephone," and there were some papers on electrical instruments and aluminium.

In the Engineering section an interesting paper was read by Mr. W. H. Booth on "The Smokeless Combustion of Bituminous Fuel." The author pointed out the difference between long and short flaming coal, and discussed the refrigerating effect of volatilising solid hydrocarbons in its effect on the distribution of temperature in a furnace, and the production of heat at and beyond the grate furnace. Another good paper was by Mr. J. S. Raworth on "The Prevention of Smoke," which described a system for the prevention of the formation of smoke in a boiler furnace by injecting a mixture of air and nitrate of soda solution on to the fire.

The different sections concluded their work on Wednesday, but several excursions have been arranged for those who want to see more of the North of Ireland.

EXHIBITION OF COMPETITION DRAWINGS FOR NEW MUNICIPAL OFFICES, CREWE.

THE forty-four sets of designs submitted in competition for the new municipal buildings to be erected at Crewe have been on view this week at the Co-operative Hall, Crewe. The schedule of requirements and the instructions to architects competing were laid down in a straightforward way, and the assessors' recommendations and report seem to have been accepted *in toto* by the Corporation. The sum to be spent is 14,000*l*. The drawings required were as few as they could well be; no perspective drawing was allowed. Except that the drawings had to be shown on the scale of 6 ft. to 1 in., architects had nothing to desire. We wonder sometimes why committees or assessors who draw up competition regulations will choose unusual scales; 16 ft., 8 ft., and 2 ft. to 1 in. are the usual scales by which work is the most easily realised, and until the metric system is introduced it cannot be bettered. The site for the proposed buildings has practically only one frontage, that to Earle-street; the back faces on to what is called Corporation-yard, and cannot be seen; on either side are party walls, so that entrances have to be obtained either from the front or back; this applies also to lighting, except for areas, at the competitors' discretion.

The result of the competition should be satisfactory to everybody concerned, for there can be no doubt that Mr. Hare has won with the best design, and, indeed, there was no serious competition for the first place. The form of the first premiated design is simple, the site occupied by the building being square; it is divided into halves by the entrance vestibules from Earle-street in the front, to Corporation-yard in the back, and divided again longitudinally by the hall, grand staircase, lavatories, and two areas; the four compartments, which this arrangement divides the building into, are occupied respectively by the Borough accountant and the Weights and Measures on the right, balanced on the left by the Rates Collector and the Sanitary Inspector. The first floor is quite a masterly little bit of planning; the grand staircase, ante-room, lavatories, and areas occupying the central space as below, the front to Earle-street containing a convenient suite of reception and committee-rooms, the front to Corporation-yard lighting the Council-chamber and Town Clerk's offices. The Borough Surveyor's offices occupy the whole of the second floor to Corporation-yard; the school attendance officer and medical officer's department facing on to Earle-street. The elevations are in the correct but rather dull adaptation of the Classic Rennaissance, which Mr. Hare has made peculiarly his own. It is, perhaps, not uncomplimentary to say that the back elevation is the more restful and dignified of the two. It is the planning that is irresistible, without profusion and without waste; the lighting, ventilation, and heating are likely to be most satisfactory, as the means to the end require neither explanation nor contrivance.

Turning to one of the second premiated designs under the name of Messrs. Banister Fletcher & Sons, we find the same form of plan on the ground floor as that adopted by Mr. Hare; the similarity is startling, and it is only on closer examination that the solution of the requirements is seen to be inferior; to make use of borrowed light in the public offices of Rates and Borough Accountant is a confession of weakness at the outset, enough in a keenly contested competition to place the design out of court. The first floor is occupied by the same departments as in the first premiated design, but the comparison can go no further; there are no less than four sets of lavatories shown where one over those on the ground flour would have been ample, and saved much of the littleness of the plan. Another of the second premiated designs, that by Messrs. Rodney & Denning, loses claim to attention, which in other respects it merits, by the inadequate lighting arrangements for the centre of the building, comprising the hall and staircase, and numerous passages, including the entrance vestibules, which are long and narrow. The elevation is elegant and in good taste, reminiscent of Mr. Belcher's Municipal Buildings at Colchester. We are surprised at the assessors including the design by Mr. A. E. Dixon, of Leeds, among the three second premiated designs; both on the first and second floor he shows important rooms lit from the west side, where no light is, avoiding conditions in a way to make planning easy; in other respects the design is sane and workmanlike.

A capital design is that by Messrs. Armstrong & Wright, of Newcastle-on-Tyne; the entrances and corridors, it is true, are too narrow, and the areas too small; but in most respects it is superior to any of the designs awarded second premiums. The elevations are simple, and would have been very pleasing in execution.

Of the remaining designs it is impossible to speak individually. Most of them show ability to deal with the problem before them. We noticed a design by Mr. W. E. Devlin, of London, very good in parts, but too disconnected for public offices to run smoothly in the working. A design by Messrs. Butler, Wilson, & Oglesby, of Leeds, was also noticeable.

We congratulate the Corporation of Crewe on getting Mr. Hare as their architect for their Municipal Buildings. Incidentally we may mention that in a set of conditions for a competition shortly to take place, in which Mr. Hare is assessor, it is laid down that the design is to be the actual work of the architect under whose name it is submitted, and a declaration to this effect is to be signed and delivered with the design. The general adoption of such a condition would tend to put a stop to the system of competition designing by proxy, an abuse which is far more prevalent than the public imagine.

THE SANITARY INSTITUTE CONGRESS.*

THE Conference of Municipal Representatives resumed its sitting on Thursday last week when two papers were presented and read before the Conference of Municipal Representatives on the Housing Question—the first by Councillor Fyans (Wigan), entitled "The Housing Problem," the second by Dr. J. F. Sykes (St. Pancras), on "The Housing of the Working Classes."

Councillor Fyans said Medical Officers of Health and Sanitary Inspectors had repeatedly brought to the notice of Local Authorities throughout the United Kingdom the appalling circumstances under which some of the poor lived—in hovels unfit for human habitation. Even where earnest attempts had been made to improve the conditions of dwelling and living very little had been effected compared with what required to be done. Many municipalities were ready to enter on schemes of improvement and development where there was some prospect of eventual profit, but remained dormant when it was a question of housing the very poor. In other cases schemes of demolition had been hastily conceived and carried out with disappointing results, the poor unhoused either being driven to seek shelter with other poor families, by which the evil of overcrowding became aggravated, or forced to seek houses in districts where sanitary regulations were less vigorously enforced. So long as private property in land was recognised to its present extent, so long would the difficulty remain of purchasing land for building cottages upon, and it was that difficulty which prevented the success of the earlier attempts of Municipalities in carrying out their schemes. In some instances it had been found possible to carry out beneficial building schemes where a resolute policy had been adopted to use all the powers at present possessed by Local Authorities with courage and perseverance, but in the majority of cases public bodies had been deterred from using their powers by the legal difficulties they had to encounter.

Dr. Sykes attributed the congestion of the population, towards which the greatest tendency was shown in the largest towns, to a number of causes, which drew to them constant accessions of immigrants from the country and from abroad. This increase from without and the natural increase found in large populations went on until the pressure of the population caused the demand for houses to outstrip the supply, and then a process of overcrowding set in which multiplied the dwellings without increasing the number of existing houses. The number of rooms in each dwelling became reduced, leading to the overcrowding of domestic conveniences, and then to an increase of the number of persons living in a room, which led to the overcrowding of air space. At this stage the building regulations ceased to become effective, and the control of the Authorities became insufficient. Unfortunately there was no statutory definition of overcrowding for dwelling-rooms, and no definition of the requirements of a dwelling apart from a house as a whole. There were statutory regulations which protected men awake and engaged in workshops and factories, but none to protect them in their homes while resting and sleeping. Among the numerous remedies proposed were, for rural districts, the provision of less costly dwellings, for which it would be necessary to modify the building regulations regarded as necessary in towns, and to obtain financial facilities which would enable Local Authorities, landowners, or companies to erect cheaper cottages. For large towns the remedies were more numerous, for the problem was more complex. Houses were being multiplied in the suburbs and means of cheap transit were being established, but that did not entirely meet the case. The two objects to be attained were sufficiency and efficiency of accommodation. Insufficiency could be overcome by the erection of new dwellings, and if the provisions of the Building Acts and the by-laws were properly enforced, then efficiency would be more or less secured. It was necessary to control the proper usage of new houses in order to prevent deterioration, but in maintaining control the Authorities were hampered by a labyrinth of legal decisions. An Authority could not at present condemn a room or a part of the house which might have become unfit for habitation without condemning the whole house, a proceeding often so obnoxious that the existence of nuisances, so long as they were only partial, was tolerated rather than that odium should be incurred by condemning a whole house because of one insanitary room. The Authority should have power to deal with individual rooms without reference to the rest of the house. The house duty which during fifty years had caused endless trouble with the Inland Revenue Department should be abolished and some other Imperial tax should be substituted. Why not put a definite tax on all separate dwellings which could not show that they were possessed of such domestic and sanitary conveniences as would satisfy the Medical Officer of Health? The decision of a case in May last year (Weatherit *v.* Cautley), which defined the dwellings in a collection of dwellings in one large building as not only "separate dwellings," but "separate houses," had cleared the way, and was of extreme importance as showing the inevitable course of future events. We might now treat as a "separate house" each dwelling in a collection of dwellings upon which the landlord did not reside nor have control over the front door. Legislation should distinguish houses let as single dwellings from others let in separate dwellings; between those that had water supplied from the mains and those that had not; and between those having a water-carriage system for excreta and those having dry systems. The Public Health Act should

* Continued from last week, p. 231.

permit of the condemnation as a nuisance of any dwelling-room having less than 400 cubic feet of air space for each inmate over ten years, and 200 cubic feet for each inmate under ten, or which was so damp as, in the opinion of the Sanitary Inspector, to be prejudicial to health. Rooms which have no window, or have window-space of less extent than one-tenth of the floor space, should be condemned, or any dwelling not possessing proper means of warming and cooking in at least one room of the dwelling. Dr. Sykes would amend the Public Health Acts so as to include as nuisances separate dwellings where wash-house accommodation was not sufficient for each family to use at least once a week, and if the common staircase had not through ventilation into the open air.

In the discussion which followed, Miss Cochrane (St. Neots) said the condition of many villages, particularly in the South of England, was deplorable in respect of dwellings, sanitation, and water supply. There was great need for more efficient inspection by both sanitary inspectors and medical officers.

Mr. F. Fildes said the sanitary inspector in Manchester had power to go into the houses in the performance of their duties at any time, even at night. In Manchester they were doing their best to relieve the centre of the city, and the slums would be found much less objectionable than formerly. In the Corporation dwellings, and particularly in the scheme being carried out at Blackley for the better housing of the people, they had hopeful auguries for the future. With regard to the "garden cities" movement, it had his full sympathy, but he feared its promoters had a difficult task before them. Working concerns were carried on as matters of business, with a view to profit-making, and people who engaged in business could not be philanthropists, as they must be if they took their workshops out into the country districts simply for the sake of housing the people.

Dr. Boobbyer (Honorary Secretary of the Conference) wound up the discussion. He said that in all their discussions of these questions they were constantly confronted with the necessity for a reform of the Acts dealing with these matters. A consolidation and revision of the Acts would solve the difficulty. In his experience of a town of 250,000 inhabitants he could tell them of some things that were very startling. Several towns had had their fingers burnt to a painful extent in attempting to carry out the Acts. After obtaining a Provisional Order under Part II. of the Housing of the Working Classes Act, a scheme had been proposed which would cost 96,000*l.*, but they afterwards found that the actual cost would be 196,000*l.* It was true, as Dr. Sykes had pointed out, that before they could correct a nuisance in a single room of a house they must close the whole house. They might obtain a closing order under Part II. of the Housing of the Working Classes Act, but the Health Committee could not make an order for demolition until they could satisfy the magistrate that the houses were a nuisance. He knew a case in which thirty-six houses were condemned and shut up, but they could not satisfy the magistrate that as they stood empty they were a nuisance, and they remained standing, and were afterwards rehabilitated and let as new dwellings. Then they came to the extraordinary action of the Local Government Board in demanding that the new dwellings should be of such a class as to be beyond the means of the working classes. In that city 1,600 houses were to be cleared for the extensions of the Great Central Railway, some of the oldest in the city letting at rentals of from 1*s.* per room to 5*s.* 6*d.* for the better-class house. The Local Government Board would not approve, to replace them, of houses worth less than from 7*s.* to 8*s.* 6*d.* a week rent. The consequence was that other houses in the neighbourhood became terribly overcrowded, and some of them were made into tenements of the worst description. The only course was to make private dwelling-houses into lodging-houses. They could deal much more effectively with these various evils if they could secure the revision and consolidation of the Public Health Acts, which should include the Housing Act and the Food and Drugs Act.

After some further discussion as to the terms of a resolution to be submitted to the meeting, in which Alderman Griffiths (Southport), Alderman Hobson (Sheffield), Mr. Harding Roberts (Holywell), Mr. Prince (Connah's Quay), and other gentlemen took part, the following resolution was adopted :—

"That in the opinion of this congress the period for the repayment of loans under the Housing of the Working Classes Act should be extended to 100 years for land and eighty years for buildings, and that the Local Government Board should be empowered to authorise loans at a low rate of interest."

SANITARY INSPECTORS' CONFERENCE.

Mr. Wm. Bland opened this conference, which was very numerously attended, with a presidential address, in which the leading questions interesting to Sanitary Inspectors in particular, and to sanitarians in general, were touched upon. Among the latter the new Report of the Joint Select Committee on Housing the Working Classes was referred to, and in the former class of questions references were made to the duties of Sanitary Inspectors in regard to the treatment of persons suffering from infectious diseases, the disposal and treatment of refuse, and inspections under the Food and Drugs Act. The President urged the necessity of union among all Sanitary Inspectors throughout the United Kingdom. Complete union would give every Inspector in the kingdom opportunities to advance, so that year by year they might hold their place in the front rank of the sanitary army.

After a vote of thanks to the President, Mr. F. J. Rowe (Manchester) was called upon to read a paper on "The Workshop Inspector," in which the working of the Shop Hours Act and the Shop Seats Act, as well as of the Factory and Workshops Act, was treated of. Factories were defined as places used for manufacturing purposes where motive power was employed, while workshops were places where only manual labour was employed for manufacturing purposes. The latter category included bakehouses, and it was contended that it ought to include restaurants. The overcrowding, defective ventilation, and insanitary conditions prevailing, especially in tailors' workshops, were vigorously denounced in the paper, and the Shop Hours and Shop Seats Acts were described as worthless. The author contended that the danger of discord in the administration of the Acts lay in the attempt to apply arbitrary rules and definitions to elastic and more or less varying circumstances. Personal tact on the part of the Inspector would effect much more than official coercion, which was apt to result in needless irritation.

An animated discussion followed in which Mr. Kirley (Bristol), Mr. Fyfe (Glasgow), Mr. Peers (Wolverhampton), Mr. Robins (Oldbury), Mr. Shawcross (Withington), and other gentlemen took part.

Mr. Fyfe (Chief Sanitary Inspector, Glasgow) said one or two important points of principle had been raised in the paper. The first was whether in the opinion of Inspectors the tendency should be towards flexibility or rigidity. It was certain that workshops in the centre of slumland were in a very different position from those in the country, and it might be awkward if the Home Office insisted on a hard-and-fast rule being applied in all cases. The rules as to the cubic feet of space to be allowed were sometimes absurd, and could not in many cases be carried out. There ought to be substituted a standard for pollution of air that might be allowed as a maximum. Glasgow had tried to get restaurants included as bakehouses. In many the temperature ranged from 100 deg. down to 80 deg. It should not be over 75 deg. Fans might be employed to reduce the temperature.

A paper by Mr. Peers (Wolverhampton) on "Some Factors affecting Public Health" was then read, in which pure air was set down as health's greatest factor. An inquiry, extending over two years, instituted by the Medical Officer of Health of Wolverhampton (Mr. Malet) clearly showed the appalling difference in the death-rate in a crowded court, where the air was impure, and the normal death-rate. In a town in the Midlands, where 4,561 persons were residing in 163 courts, the density rate per acre ranged between 400 and 900 souls per acre. This gave about 8 sq. yds. per person in places from which the free air was jealously excluded and sunlight could only penetrate through narrow passages or over the roofs of surrounding houses. The death-rate in these courts was found to be nearly double that of the more open parts of the town. Other factors prejudicial to health were the black polluting smoke, the ineffective control over the meat and milk supply, and the virtual immunity enjoyed by the adulterators of drugs and many articles of food.

The third paper read was upon the "Abolition of the Privy System," by Mr. E. Nuttall (Chief Sanitary Inspector of Stretford). The paper contrasted the best practice of large towns, where refuse is got rid of by water carriage through good drains and sewers, with the practice still common in rural districts, where privies in the most appalling condition of neglect are to be met with in close proximity to living rooms, wells, or other sources of water supply. Some horrible instances of sanitary ignorance and neglect in rural districts were given by the author in advocating the conversion of privies, even in country places, to the water-closet system. Dr. Boobbyer, of Nottingham, compiled a remarkable table, which showed distinctly that there was a direct relation between typhoid and the method adopted of disposing of excreta. In districts where the privy-midden prevailed, the typhoid cases averaged 1 to every 37 houses; where the pail-closet system prevailed it was 1 case to every 120 houses; and in districts where water closets were the rule only 1 in every 558 houses. The worst obstacles that a progressive Corporation had to encounter in trying to bring about this salutary conversion of privies into water-closets were the legal difficulties. A number of cases were cited where Councils and Health Committees had been defeated before magistrates, quarter sessions, and even in the House of Lords, one of the most remarkable cases being that of Barnett *v.* Laskey (Sanitary Inspector of Eccles), in which the late Lord Russell had decided against the Corporation of Eccles, where they seemed to have a very strong case. In a group of five houses belonging to Mr. Barnett there were nine cases of typhoid, and the owner was served by the Inspector with a notice to convert the privies into water-closets. The owner failed to comply, and the Corporation did the work and sued for the cost. The magistrates rejected the suit, and their decision was confirmed on appeal to the House of Lords. The author concluded his paper by advising Local Authorities who desired to get rid of these foul privies to obtain powers for that purpose by private Act of Parliament. He suggested that the conference should pass a resolution in favour of consolidating and amending the Public Health Acts.

In the discussion which followed,

Mr. Laskey said that in 1895 Dr. Bruce Lowe, representing the Local Government Board, told the authorities at Eccles they had full power to deal with this matter. The Health Committee might not have power to issue a general order, but they would have no difficulty in exercising their powers when a house had been proved a nuisance. The Health Committee, relying upon the advice of Dr. Lowe, had issued separate notices, and in a large number of cases they had been complied with, and closets had been substituted. The necessity for this substitution would be admitted in the case of towns which had an adequate water supply and adequate sewerage, but in certain country districts where there was no water supply a privy might not be the worst form of sanitary convenience. Cesspools were quite as bad, if not worse. Privies should undoubtedly be abolished in towns and crowded areas, but in country districts where they did not pollute the water supply they might be allowed to remain. The Local Government Board still persisted in obstructing certain local authorities who were trying to get powers which had been obtained by other districts. Why did not the Local Government Board itself obtain an amended Public Health Act applicable to the whole country? Eccles, Stockport, Southport, and many other towns must spend thousands of pounds to obtain private powers, but the cost would be infinitesimal if divided over the whole country.

The discussion, which at this point was adjourned for the day, was resumed on Thursday by

Mr. Lowe (Widnes), who described a modified form of privy which had been tried at Widnes, and which was peculiar to Widnes thirty years ago. It failed because bricks, cans, and other things got in and choked the outlet. What would be the cost of getting a Provisional Order to convert?

The President (Mr. Bland) said Mr. Laskey had stated that it would cost from 1,500*l.* to

2,000*l.* He would like Mr. Nuttall to tell them how far that would go in promoting conversion.

Mr. Spears (West Bromwich) and several speakers protested against the payment to owners of property out of public money of any part of the cost of conversion of privies to water-closets. They invariably put up the rents after such conversion. Owners ought to be called upon to convert without any offer of compensation.

Mr. Drow (Otley) sketched on the blackboard a form of makeshift or modified closet he devised twenty-two years ago for a district that had no satisfactory water supply and no system of sewage disposal.

Mr. Priestley (Nelson) said that ten years ago there were in his district from 2,000 to 3,000 cesspools, but they had got rid of them all. They never had any difficulty in putting the law into force. They had had full powers for sixteen years, and he was surprised that any district should remain without them. He thought in these cases there must have been some remissness. There was an idea that waste-water closets were more economical than ordinary closets. He thought this was a mistake. With waste-water closets the sewage was more concentrated and more expensive to treat. Water companies should be made to understand that waste-water closets did not effect any saving. The taps were apt to be kept open, particularly in winter, and more water was thus consumed.

In reply to a question whether, in a case where there was only one water-closet to three houses, the Local Authority could compel the owner to provide one to each house, the President quoted Section 36 of the Public Health Act, which gives power to the Local Authority to compel owners to provide sufficient water-closet accommodation.

Mr. Nuttall, on being called on to reply, said he had not advocated conversion in all cases. Where there was no water supply and no sewage disposal system available privies might be allowed to remain, but even then there should be a thorough inspection, and where a privy was found to be too close to a building it should be condemned. He thought the central authorities were more favourably disposed now than formerly. Mr. Lowe, of Widnes, asked how they were to proceed to get rid of the privies. He had written himself to Widnes, and found they had taken no action. In his own district they had succeeded in getting many owners to convert, and in other cases they had assisted owners by paying a part of the expense of conversion. From 1898 to 1900 they had got from 700 to 800 privies converted to water-closets, and up to date they had 200 more. In reply to Mr. Bland, he said if there was not too large a number to be converted it would no doubt be more economical to assist the owners than to incur the expense of getting a private Act. He did not approve of Mr. Drow's modified closet, and in reply to Mr. Priestley, he said a Provisional Order had the effect of an Act of Parliament. It was necessary to send a separate notice for each house, and every case had to be dealt with on its merits.

Mr. J. J. Elliott was called upon to read a paper on "House Drainage and Sanitary Plumbing from an Inspector's Point of View." He said the control of drainage and plumbers' sanitary work was of the utmost importance, and good and thorough work should be enforced by legislation. Drains inside premises were often broken into for cleansing, or altered, or reconstructed without any responsible official being acquainted with the fact, the result being that the drains are probably left in a very imperfect condition, and what may previously have been a drain as defined by the Public Health Acts may have been converted into a sewer by the juncture of some branch drain from an adjoining premises belonging to the same owner, thus increasing the responsibility of the Authority. It should be imperative that no drain or sewer be laid, reconstructed, opened, or uncovered without the consent in writing of the Authority or their representative, penalties being imposed for non-observance. The same should apply to all sanitary plumbers' work, and all such work should be tested and passed by the Local Authority's Inspectors. Drains should be tested periodically at least once in three years, and the Local Authority should be kept informed of all changes taking place in the drains in its jurisdiction. If certificates were granted to owners of property stating the date of the testing of their drains, much good might accrue. The registration of plumbers was a step in the right direction, but it would not stop bad work. A uniform system of drainage and sanitary plumbers' work is a thing very much to be desired, and many advantages would accrue if such a system existed. It would be hailed with delight not only by property owners, but by contractors, manufacturers, and Inspectors alike. In concluding his paper, the author suggested that a council of experts in drainage and plumbers' work should be organised, preferably by the Sanitary Institute, to devise a suitable system of testing drains, and to recommend it for consideration to various Corporations and Councils with a view to its ultimate adoption.

Mr. Cowderoy (Kidderminster), in opening the discussion, maintained that builders and drain-makers, as well as plumbers, should be registered. The testing of drains should be renewed from time to time. He might pass a drain, but he would not give a certificate. He would put nothing down in black and white. If owners wanted certificates, let them go to the professional surveyor or architect for them.

Mr. Laskey (Eccles) said when bad plumbers' work was done it was not always the plumber that was to blame. More often it was the fault of the property owner. In their private Act they had a clause inserted to prohibit the opening-up or altering of any drain without the sanction of the Local Authority and without giving notice. The Public Health Acts ought to contain such a clause, which would benefit the whole country.

Mr. Bradley (Rawtenstall) said they had appointed in his Borough an Assistant Surveyor who did nothing else but draw plans of the drains and keep them for reference, so that when a fault occurred they could always go at once to the spot to repair it.

Mr. Fyfe (Glasgow), Mr. Robins (Oldbury), Mr. Hudson (Cheltenham), and Mr. Johnson (Wimbledon) continued the discussion, and Mr. Wilkinson (Derby) proposed the following resolution, which after some further discussion was carried unanimously: "This conference is of opinion that the time has arrived when no person should be allowed without permission of the Local Authority to open up, alter, add to, or otherwise deal with the drainage or sanitary appliances of any house or building or premises, and that all drains and sanitary appliances be constructed and required to stand the hydraulic or other equally satisfactory test to be applied by the Inspectors of the Sanitary Authority before such work be covered from view or passed."

Mr. T. G. Dee (Sanitary Inspector, City of Westminster) read the last paper, which was upon "The Sale of Food and Drugs Acts." The conference adopted a resolution in favour of the creation of a "court of reference," which should have power to prepare a standard for every article of food used by man—a tribunal which the author demanded as a pressing necessity.

CONFERENCE OF ENGINEERS AND SURVEYORS.

On Wednesday a numerously attended conference of Engineers and Surveyors was held at the School of Technology, with Mr. C. Jones (Borough Engineer, Ealing) in the chair, at which, after an address from the Chairman, papers were read on "Sewer Ventilation," by Councillor Dr. Dearden (Manchester) and Mr. A. M. Fowler, M.Inst.C.E.; on "Refuse Disposal," by Mr. W. H. Hamblett; and on "A New Sewer Scouring Machine," by Mr. J. Corbett (Borough Engineer of Salford).

Dr. Dearden classified the plans for ventilating sewers under three heads, viz., natural ventilation, artificial ventilation, and deodorisation systems. Of sixty towns from which he had received information twenty-eight pinned their faith to surface grids, but twenty of these had a few shafts to accommodate special circumstances. They were objectionable from the general belief that proximity to a street grid might induce zymotic disease. With the view of testing the soundness or fallacy of this belief, the Manchester Committee intended to have fresh bacteriological experiments to obtain a comparison between the air of the sewers and that of the streets outside. High shafts were adopted by twenty-three of the sixty towns as a means of ventilating the sewers in combination with surface grids. The mathematically precise experiments carried out at Leicester by the Borough Engineer (Mr. E. G. Mawbey) had proved of the greatest service. In four towns the drains were disconnected and the high shafts of mill chimneys were utilised, but the results did not seem very satisfactory. Ventilating lamps, water jets, fans, and other mechanical contrivances were in use in a few places, about the efficacy of which opinions greatly differed. The chief deodorisation plans were the Reeve's system, the use of suspended blocks of pyrozone, and Mr. Caink's combined air-filter and deodorant. All these appeared to be more or less good palliatives, but there was a liability to have the supply of water cut off which might be advanced against the "Reeve's system."

Mr. Alfred Fowler briefly referred to the contributions to our sanitary knowledge made by the late Captain Veitch, R.E., the late Sir Robert Rawlinson, the late Sir Joseph Bazalgette, the late Mr. Thomas Waring, of Cardiff, and Dr. Robinson (now of Dover), who, in conjunction with the author, had made experiments on sewers on the upper levels in Leeds and other towns. The author refrained from expressing any opinion on the merits of the systems now before the public. In concluding his paper, he said it would be seen that a great deal can be done to prevent the accumulation of vitiated air, and to shut off the sewer air from discharging at any particular point, especially in cases where sewers are of steep inclination. The attention required for all systems of ventilation is more particularly necessary in the case of street gullies, as it is not always an easy matter to keep the water traps sealed in time of drought, when they sometimes emit foul emanations from the sewers into the streets, and at such times would also prevent the extraction of sewer air from a distance by mechanical power.

A cordial vote of thanks was given to the readers of the two papers, which was supported by Dr. S. Rideal, Dr. Nash, Mr. Mawbey (Leicester), Mr. Brodie (Blackpool), Mr. J. F. Price (Birmingham), Mr. Parker (Hereford), Mr. Grimshaw (Manchester), and other gentlemen who joined in the discussion.

Mr. J. F. Price said that an artificial system of sewer ventilation would cost 125,000*l.* if introduced in Birmingham, and its perfect success in a town like that, where there were many old sewers of which there was no knowledge, was somewhat doubtful. Difficulties of other kinds were pointed out by other speakers. The great difficulties at Grimsby, for instance, arose from the fact that one-fifth of the town was below high-water mark.

The conference then concluded.

ENGINEERING AND ARCHITECTURE.

The first sitting of this section, which took place on Thursday, and over which Sir Alexander Binnie presided, was occupied with the presidential address and papers by Mr. E. G. Mawbey, Mr. H. D. Searles-Wood, Mr. Clayton Beadle, Mr. Louis Hanks, Dr. Henry E. Armstrong, and Mr. J. A. Paskin.

In his address Sir Alexander Binnie referred briefly to the advances made in sanitary science during the forty years of his professional life, and congratulated the Sanitary Institute on the great success that had followed their efforts during the last twenty-six years to promote the health and happiness of the people of this country. After referring to the successive difficulties met with in their efforts to dispose of the refuse and sewage of towns, and the various methods by which we have endeavoured to overcome them, the President referred to the paramount importance to the public health of an ample and sufficient supply of pure and uncontaminated water. The purification processes we were now adopting drove him to conclude that "either our large towns, such as Edinburgh, Glasgow, Manchester, Leeds, Liverpool, Bradford, Birmingham, and many others, have uselessly expended millions of money in attaining an ideally pure water supply, or that the people of London are running a great risk in continuing to depend almost entirely on the waters of the Thames and the Lea, which received the more or less clarified sewage effluent of over a million and a quarter persons." With regard to pure air, the President charged against the open fire grate—the most wasteful mode of utilising fuel—a great deal of the contamination of the air of London. With electricity for the interior of our houses, gas instead of crude coal for heating and cooking, and incandescent gas-lamps for the streets, a great improvement could be made in the air of our towns. In concluding his address, the President, as an old municipal officer, advocated the devolution by Parliament of matters of purely local interest into the

hands of our local governing bodies and County Councils. It would be much more effective to give to these local bodies a free hand than to spend energy and valuable time in the Legislature in attempting to devise measures which, unfortunately, too often appeared to hinder instead of expediting the objects in view.

On the motion of Professor Robinson, a cordial vote of thanks was given to Sir Alexander Binnie for his address.

Mr. E. G. Mawbey (Borough Engineer, Leicester), then read a paper on "The Sanitation of Road Traffic." The author advocated the substitution of hard, impermeable stone paving, common to our best-cleansed towns, for the permeable stone paving and the ordinary macadam of our roads. The paving recommended by Mr. E. P. Hooley, County Surveyor of Nottingham, was an excellent step in the right direction. The replacing of horses by electric traction and automobile cars must effect a substantial improvement in the road and street sanitation of towns.

In the discussion, Mr. A. M. Fowler pointed out the nuisance to business in Manchester caused by the hard paving of the streets, the noise in which was so great that in offices adjacent to the streets it was often impossible to dictate a letter to a clerk. It might be cheaper for the Corporation to stick to paving that would last ten or fifteen years, but it was subject to the drawbacks of greater noise and greater wear and tear of horseflesh.

The next paper read was by Mr. H. D. Searles-Wood on "Means of Escape in Case of Fire." He detailed the history of the first enactment in this matter, and quoted from various Factory Acts and the regulations of the London County Council as to the provision of means of escape in case of fire. He also quoted and dealt with the fire-escape regulations in New York and Vienna, and also the rules for standard fire-resisting buildings of the Fire Offices Committee.

The remainder of the sitting was occupied by the reading of the papers on "The Abstraction of Underground Water and its Local Effect"; "Sanitary House Decoration," by Mr. Louis Hanks; "The Working of a New Sanitary Appliance used by the Health Department at Newcastle-on-Tyne"; and "The Pollutions of the River Calder."

The sitting was adjourned, there being no time left for the discussion of the papers.

Sanatoria for Consumptives.

A combined meeting of Sections I. and II. (Sanitary Science and Engineering and Architecture) was held on Friday, for the purpose of a joint discussion of papers by Mr. Edwin T. Hall, F.R.I.B.A., on "Sanatoria for Consumptives"*; on "The Provision and Construction of Sanatoria for Tuberculosis," by Mr. W. Cecil Hardisty, and Mr. W. S. Cross, F.R.I.B.A., and Dr. Welsford; and addresses from Dr. J. Milsom Rhodes on "The Provision of Public and Private Sanatoria"; Dr. Scurfield on "Suggestions for the Employment of Consumptives after leaving Sanatoria"; and by Drs. Moritz, Cooper Pattin, and Veterinary Surgeon Hunting on "The Prevention of Tuberculosis from the Clinical, Municipal, and Veterinary Points of View."

Mr. W. Cecil Hardisty, architect, Manchester, in his paper on "The Provision and Construction of Sanatoria for Tuberculosis," said: We can adequately provide for the treatment of tuberculous cases as we do for all varieties of infectious fever, for the epileptics and the insane, it is better that we should do so, rather than be obliged to send such cases far away in search of cure, and the possibilities of this cure "at home" should be open to the very poor as well as to the rich. Though sites of the altitude of many of the continental sanatoria are not available, altitude is not everything, provided the principal requirements of dryness and shelter be complied with. Out of twelve British sanatoria for paying patients only three are at a greater altitude than 400 ft. above sea level, and good results are recorded at all of them. In the planning of the sanatorium large wards are not desirable, but rather a liberal provision of single bedrooms for the patients; and to avoid the extravagance which the provision of single rooms for all would entail it is well to have a few small wards for four or six beds each. The six-bed ward is about as large as will be found desirable. Open balconies at the upper-floor levels in front of the bedroom windows, which should in all cases open down to the floor, are better than verandahs in front of the ground-floor windows; they need not be more than 4 ft. in projection from the wall, as this is ample to allow of the bed or couch being laid longitudinally thereon if the patient be too weak to enjoy outdoor exercise. The balcony is much more "airy" than the covered verandah unless the latter can be arranged somewhat after the manner of those at Ruppertshain, in Germany, where they are lateral extensions to the east and west of the main building, and, of course, offer no obstruction to the free circulation of light and air. But of more importance still is the ample provision of small shelters in the grounds at a reasonable distance from the building. These compel the patients to enjoy a little walking exercise, and induce them to indulge fully in the "open-air" treatment, and the shelters should be so arranged as to screen the occupants from the cold winds. Large and well-lighted, cheerful, and bright sitting-rooms should be provided, for, though the "open-air" treatment is the chief object of the sanatorium, there are times when a little social intercourse amongst the patients is advantageous and beneficial. Due attention, of course, must be paid to the plain upholstered furniture, and the entire absence of heavy pile carpets and tapestry curtains. The dining-hall should likewise be as light and cheerful as possible, and it is of great importance that it should be entirely isolated from all other parts of the hospital, and equally isolated by means of a well-ventilated corridor from the kitchen. The kitchen should be lofty and well ventilated at the roof, no rooms, of course, being placed over it. Special attention should be paid to the proper planning of the sanitary adjuncts. The baths and water-closets should be placed in turrets, in themselves well ventilated, and should be completely isolated by means of cross-ventilated connecting corridors, entirely detaching them from the main building. The further adjuncts of a well-planned and equipped sanatorium will readily suggest themselves, such as ample provision of patients' clothes stores, where garments not in general daily use can be put away, thus relieving the bedrooms of superfluous furniture, of which the less there is the better. Boot-rooms and boot-cleaning-rooms are likewise useful accessories, and, of course, in addition to the nurses' duty-rooms, servants' rooms must be provided, where the sundry domestic articles for cleaning, &c., can be kept. The nurses and domestic servants should be provided for in a "Home" at some little distance from the main building.

A part of the paper by Messrs. Cross and Welsford will be found on another page.

In the discussion which followed,

Dr. J. Milson Rhodes said that if the public only knew the vast amount of money spent annually on the treatment of phthisis they would do something to prevent the enormous number of cases that existed. We spent from the rates over a million sterling annually on this disease alone, which produced 43,000 widows and 33,000 other paupers, making a total of 76,000 paupers to be provided for out of the rates because we had neglected to provide decent homes for the poor. The provision of sanatoria would be a real saving, but what he would most like to see was "every man's house a sanatorium."

Dr. Nocard (Delegate of the French Government), who spoke in French, described some remarkable experiments made by professors at Geneva, Berlin, Amsterdam, and other Continental centres, tending to disprove the declaration made a year ago in London that animal tuberculosis could not be transmitted to man.

Dr. Glover Lyon (London), in reference to the question of the construction of sanatoria, said they did not require ornamental or architectural structures, but simply groups of shelters. To be built on the right line they should have a south-easterly direction, because the south-east and north-west winds were the rarest in this country. If built with a southern aspect, all the beautiful evening sunlight would be lost.

Dr. Bostock Hill, Dr. Alfred Hill, and Dr. Niven all strongly urged the necessity of better education in sanitary matters. The education should begin in the cradle, and continued in the elementary school. Better than getting Acts of Parliament for closing and rebuilding dwellings would be to endeavour to teach the people how to select good houses, and reject the houses that were insanitary.

The President, in closing the discussion, commented upon the most salient points brought out in the papers and the discussion. He was particularly struck with the remarks of Dr. Alfred Hill upon the educational side of the question. "I hope," said Sir James, "that tuberculosis will become the bogey of our schools."

The following resolution was subsequently adopted on the motion of Dr. James Armstrong, seconded by Dr. J. F. J. Sykes:—"That this congress request the Sanitary Institute to prepare and issue, in a condensed form, a summary of the present knowledge on the treatment of tuberculosis, as obtained at the recent International Congress and elsewhere, and that the Committee of the King's Sanatoria be invited to join in the publication."

CLOSE OF THE CONGRESS.

On Friday afternoon a general meeting of the congress took place, at which Sir James Crichton Browne presided, and at which the reports of the hon. secretaries of conferences and sections were presented. The secretary of the Sanitary Institute (Mr. E. White Wallis) made a brief report of the Congress, which had proved in every respect successful. The total number of members attending had been 2,100, made up of members of the Sanitary Institute, delegates from the French Government, from the Secretary of State for War, Army Medical Department, and the leading Corporations of Lancashire and the surrounding counties, and Local Authorities throughout the kingdom. Votes of thanks were accorded to Earl Egerton of Tatton, the President of the Congress, the Principal and Senate of Owens College, the local committees and secretaries, the honorary officers of the Congress, and the numerous gentlemen and ladies who had contributed to the hospitalities and entertainments.

In closing the proceedings, the Chairman said the Congress had been one of great usefulness, enjoyment, and interest. Abundant proof had been given that in Manchester the sanitary spirit was very active, and that most admirable work was being carried on.

A vote of thanks was accorded to Sir James Crichton Browne, the Chairman, on the motion of Dr. Sykes, seconded by Mr. E. G. Mawbey.

We shall print in our next issue an article on the Health Exhibition which was opened at Manchester last week in connexion with the Sanitary Institute Congress.

ASSOCIATION OF MANAGERS OF SEWAGE DISPOSAL WORKS.

An extraordinary meeting of this Association was held on Saturday, September 13, at the School of Technology, Manchester, for the purpose of hearing an address from the President of the Association, Dr. S. Rideal, who was unfortunately unable to be present. Mr. J. Ashton (Chairman of the Manchester branch of the Association), and Mr. C. H. Ball (Newmarket, honorary secretary), were present, and members from Bolton, Barnsley, and other towns in Lancashire, Yorkshire, and the adjacent counties.

Mr. Ashton, who presided in the absence of the President, called upon the Secretary to read the names of fourteen candidates for membership, all connected with sewage treatment works at Barking, Grays, Edmonton, Barnet, in the metropolitan area, Bristol in the west, or towns in Lancashire, Yorkshire, and Derbyshire. The Association, which was formed only in December last, already has a total of eighty members on the roll. The meeting decided that the annual meeting of the Association should be held in London on Friday, December 12 next. Some other formal business having been transacted, the meeting was adjourned for the purpose of a visit of inspection to the Salford Corporation sewage works at Weaste, on the invitation of the Engineer and Works manager, Mr. J. Arnold, who was present to conduct the party.

On the arrival of the members at Weaste, they were hospitably received by the manager, and then conducted round the works, successively inspecting the tanks, to which over 2,000,000 gallons of sewage found its way daily by gravitation; the powerful engines, capable of lifting to a height of 30 ft. as much

* Part of which is printed on p. 252.

as 30,000,000 gallons of sewage daily, an amount much above present requirements; the Tangye sludge-pumps, which raise 600 tons of sludge daily from the sludge-tanks, and force it into a sludge-steamer, which carries it out beyond the mouth of the Mersey into the Irish Channel and deposits it in the sea, where the refuse cannot find its way back to the shore. The inspection was continued to the mixing-house, where lime to the extent of 5½ cwts. per million gallons is added to the crude sewage, to the roughing-tanks, and the settling-tanks, where a new apparatus is at work removing the sludge from the tanks, and, finally, to the filter-beds, which cover an area of 26,000 sq. yds. Before passing to the filters an addition is made to the sewage of copperas (sulphate of iron) in the same proportion as the lime, namely, 5½ cwts. per million gallons of sewage, but no other chemicals are used in the treatment. The characteristic feature at the filtering-beds is the spraying of the liquid for the purpose of getting the greatest possible amount of aëration. This is effected in a very simple manner by a brass sprayer or sprinkler fixed at intervals on the top of horizontal pipes crossing from side to side of each bay in the filter-beds at intervals of 8 ft. or 10 ft. On the whole filtering area of 26,000 square yards, which in reality forms one huge filter-bed, the division into bays, not being carried down to the upper surface of the filter, 4,500 of these sprinklers are fixed at regular intervals, the effect when they are all in action being striking and beautiful. They can be worked bay by bay in any order, and the whole can be worked simultaneously; but in practice it is found best to let them rest and play alternately at three hours' interval. Each of the 4,500 sprinklers throws up the water in a hollow cone, spreading out from the centre, the drops falling in a fine rain over a circle of 4 ft. or 5 ft. in diameter. The upper stratum of the filter-bed is formed of clinker which has passed through a ¾ in. screen. This has a depth of 5 ft., but can be raised to 7 ft. Below it is a bed of coarse clinker 1 ft. thick, resting on concrete. Up to a few years ago the sludge resulting from the lime process was simply deposited on the spare land at the works, until 150,000 tons of it had accumulated, and covered the whole of the land to the depth of from 10 ft. to 15 ft. Since the works of the ship canal, which runs along the south side of the Corporation property, were begun, and the steamer could be utilised for disposing of it, the old sludge has been gradually dug out and mixed with that daily produced, the land being thus cleared and restored to usefulness. The steamer at each journey takes out 600 tons of sludge more than sixty miles out to sea, the cost of thus disposing of it working out at less than 8d. per ton. Mr. Corbett, the Borough Engineer, puts the cost of the new works begun in 1897 at 80,000*l.* when finished, bringing up the total expenditure to about 198,000*l.*, to serve a population of 250,000, or at the rate of 16s. per head, a much lower outlay than is usually found necessary. The results are regarded by the Corporation as extremely satisfactory. The effluent is odourless and clear, has a not unpleasant taste, the filtrate averaging well within the standard insisted on by the Joint Board of the Irwell and Mersey Watershed.

After the inspection the meeting was resumed, and a cordial vote of thanks was given to Mr. Arnold. In proposing it, the Chairman, Mr. Ashton, declared that the sprinkler they had seen at work (Mr. Arnold's) did its work more satisfactorily than any he had examined, and he believed he had seen them all. He had no hesitation in saying that this was the sprinkler of the future, and that the processes they had inspected perfectly solved the problem of sewage disposal for Salford, in spite of the difficulties created by the large proportion of very foul trade refuse which Salford sewage contained.

Mr. Arnold having briefly acknowledged the vote of thanks, the visitors returned to Manchester.

COMPETITIONS.

MARKET, DUBLIN.—In response to Lord Iveagh's invitation, eight architects in Dublin sent in designs for the New Market. These were submitted to Mr. C. J. MacCarthy (City Architect), Mr. Spencer Harty (City Engineer), and Colonel Addison, R.E., who awarded the first place to Mr. G. F. Hicks, the plans of Messrs. Kaye, Parry, & Ross being placed second.

Illustrations.

NILE BARRAGE AND RESERVOIR WORKS.

THE whole of our plates this week are devoted to the illustration of the great Barrage and Reservoir works recently completed on the Nile, under the direction of Sir Benjamin Baker as consulting engineer.

The whole work is described at considerable length in our leading article in this issue, to which the reader is referred.

In selecting the illustrations we have aimed at combining pictorial illustration of the aspect of the works with constructional representation in section and elevation. Thus, our first plate gives a complete perspective view of the Asyût barrage, with views of portions of the work in process of construction; the next sheet gives the elevation and section of the work. In the third we give the general plan of the Aswân Reservoir works, with two sections of the dam, and in the fourth plate two views of portions of the dam, in progress and completed.

For the material for the illustrations we are indebted to the courtesy of Sir Benjamin Baker.

SANATORIA FOR CONSUMPTIVES.*

THERE are three important factors for consideration in connexion with every project for a sanatorium. These are (1) site, which involves the questions of subsoil, altitude, shelter, prospect and aspect; (2) water supply; and (3) sewage disposal.

First, as to site. A sandy or gravel subsoil should be selected if attainable, so that rain may be readily absorbed. Stiff clay is impervious, and a site with clay not far from the surface gets waterlogged. Evaporation creates ground mists or fogs, which are very bad for consumptives. But a low-lying site on sand or gravel is as bad, because the subsoil water percolates through the subsoil and renders the earth moist and cold. This percolation also forces outwards ground air, or air charged with carbonic acid gas. The ideal site is the southern slope of a hill sheltered from north and east winds by trees. On sandy soil the trees will generally be some species of pine, the resinous exudation from which is health-giving, imparting a clean and brisk flavour to the air. Given, then, a suitable site amid trees, the next thing is to place the sanatorium in an elevated position. It is not good to put it on a flat plain. Shut in by woods, with a strictly limited prospect, the influence on a patient is bad. Again, there should be a wide clearing on the south side of the building and in a less degree on the other sides. Admit to building and to gardens plenty of sunlight. Another point of great value is to set the building well away from a high road, and in a sandy district this is of especial importance. Dust of any kind is, of course, very bad for affections of the throat or respiratory organs, and the dust from a high-road, laden, as it is liable to be, with fæcal matter and carried about by high winds, is worse than all. Of course, a good water supply is essential. Where a public service is not at hand, a spring should be available on the higher side of the sanatorium. It will there not be in danger of contamination from sewage, and the water will flow by gravitation to the building—a great saving in expense of maintenance.

Sewage purification and disposal are important matters. In small institutions earth closets are satisfactory in every way, and the limited quantity of liquid refuse, such as bath and sink water, can easily be dealt with; but in larger sanatoria some form of underground sewage disposal becomes a practical necessity. Where there is a public sewer at hand there appears to be no objection to its use.

The author then gave some information as to sewage disposal in various places in South Germany and at home. Proceeding, he said: Assuming the size of the building to be determined, we have to settle what are to be the bases of the design, and these I think may be thus set forth:—1. Let the whole be conceived on broad lines, to be and to suggest expansiveness—plenty of room to breathe and move. 2. Plenty of sunlight and fresh air into and through the patients' rooms. 3. Disconnection of all buildings containing water-closets and other sanitary appliances. 4. Separation of rooms into groups for classification of patients. 5. Limitation of destructive fires, and provision of means of escape. 6. Open-air accommodation for those temporarily unable to walk. 7. Limitation of height of buildings. 8. Housing the medical and nursing staff away from their daily work. 9. Separation of administrative buildings from the hospital proper. 10. Avoidance of all angles, ledges, and crevices for the harbouring of dust.

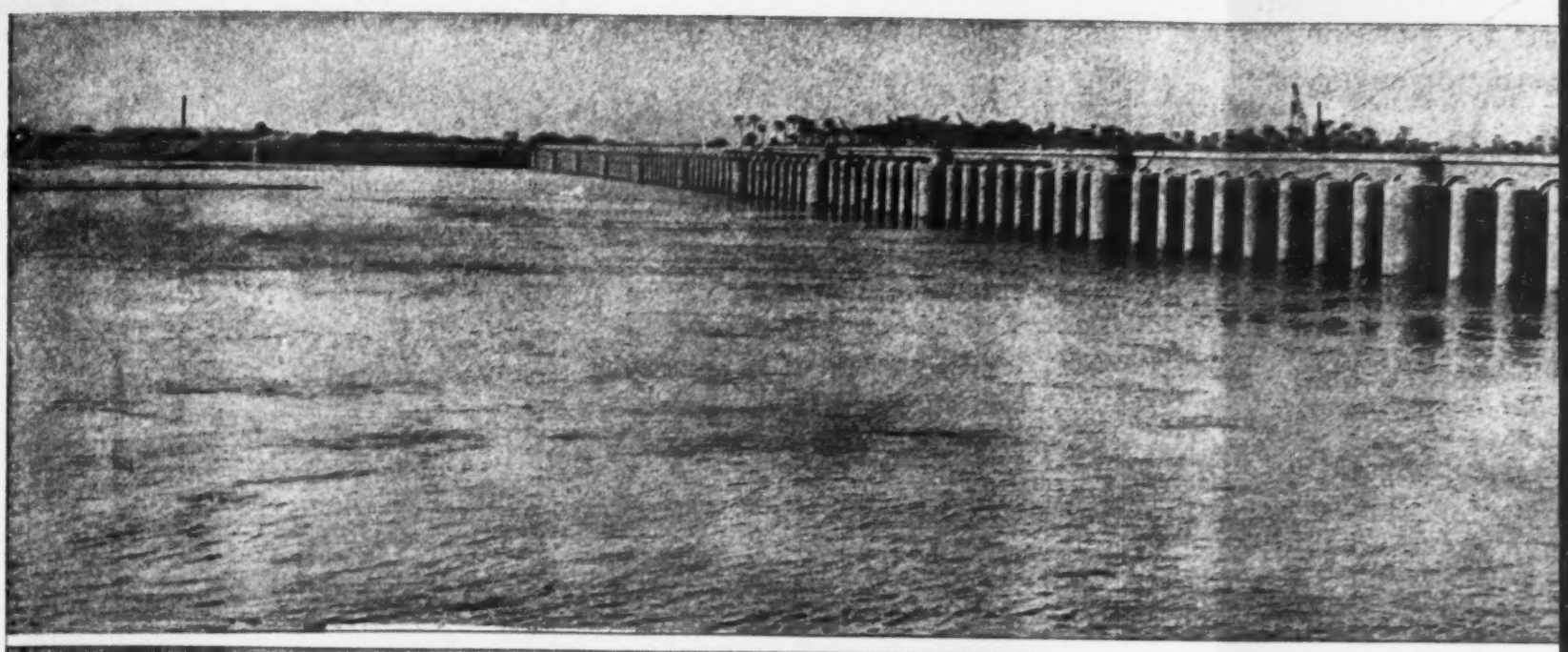
There is one all-important detail to be settled at the outset before putting pencil to paper, and that is, shall patients be accommodated with single or multi-bedded rooms? On this question there is differnce of opinion. By some it is held that for the poor rooms with more than one bed are best, as these patients like company. There are cases where two or three beds in a room may be of advantage, as where hæmorrhage is likely to occur, when one patient may temporarily help another pending the arrival of the doctor or nurse. But the majority of doctors hold that patients who have separate bedrooms do the best, as they are not disturbed by others, and the King's Advisory Committee have adopted this principle for the new sanatorium about to be erected by his Majesty.

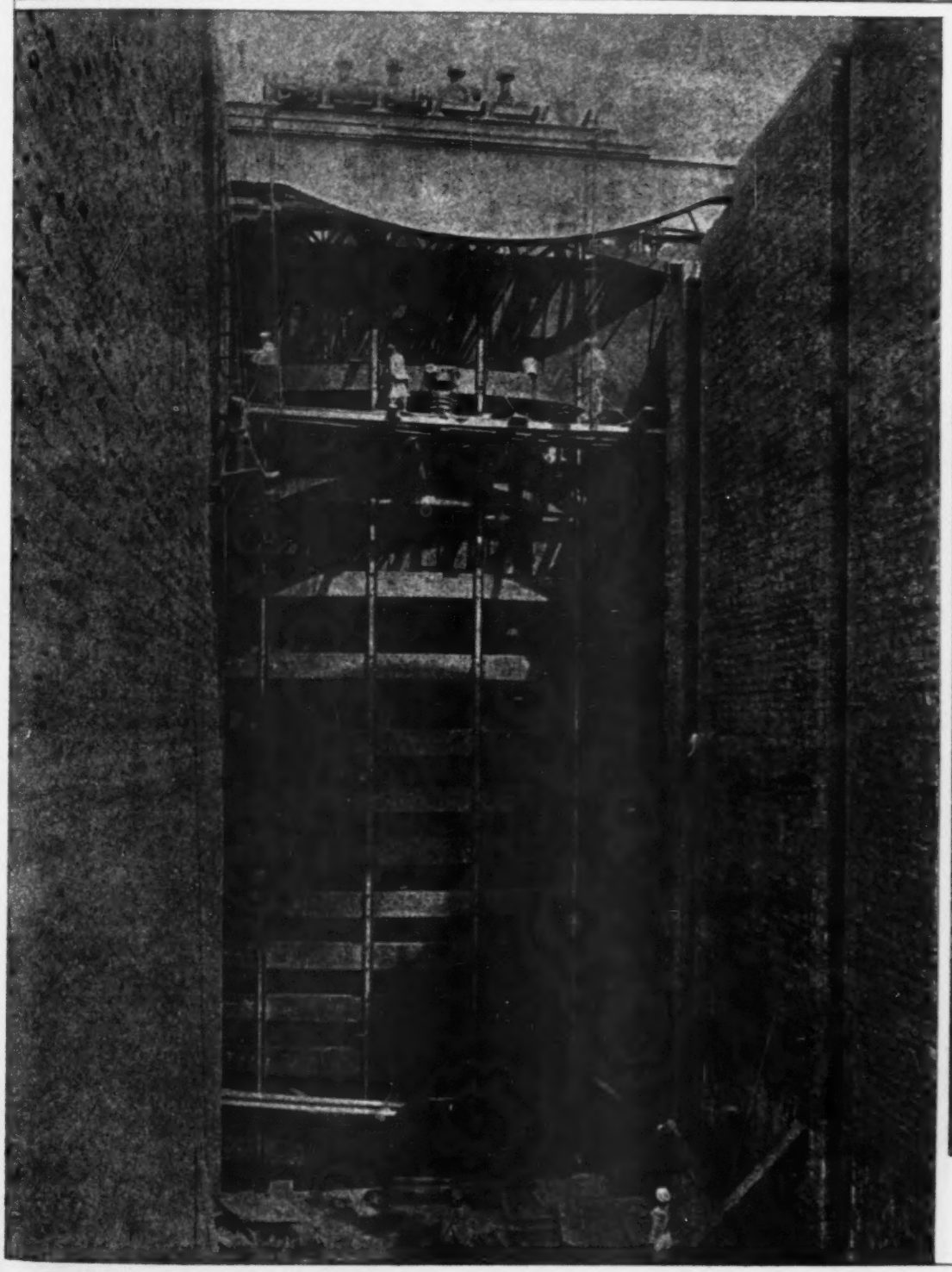
From the consideration of this subject we are led to another—viz., the external reclining balconies or liegehallen, as they are called in Germany. In these are placed couches where the patient may lie in the open air all day, and perhaps all night. Dr. Walthers, of Nordrach, does not adopt them, as he thinks they tend to make patients lazy; but they are very generally adopted, and in certain stages of the disease are doubtless of great value.

Unless otherwise mentioned, all the German institutions have double casement windows, are heated by low-pressure steam radiators with no fireplaces, and are electrically lighted. In some of the latest institutions, as Harlaching and Krailing, the administrative buildings are separate and distinct from those containing patients, but not so in others, particularly in earlier ones. For example, at Falkenstein, which is the first institution I propose to describe, the kitchens, larders, &c., are in the basement of the block. It must, however, be borne in mind that this institution commenced in what had been a private house, and although by additions it is now a large place, the original house remains part of it. The staff, except the medical men, live in the block. There are detached blocks—engine and boiler houses, stables for horses and cows, workshops, laundry, &c.

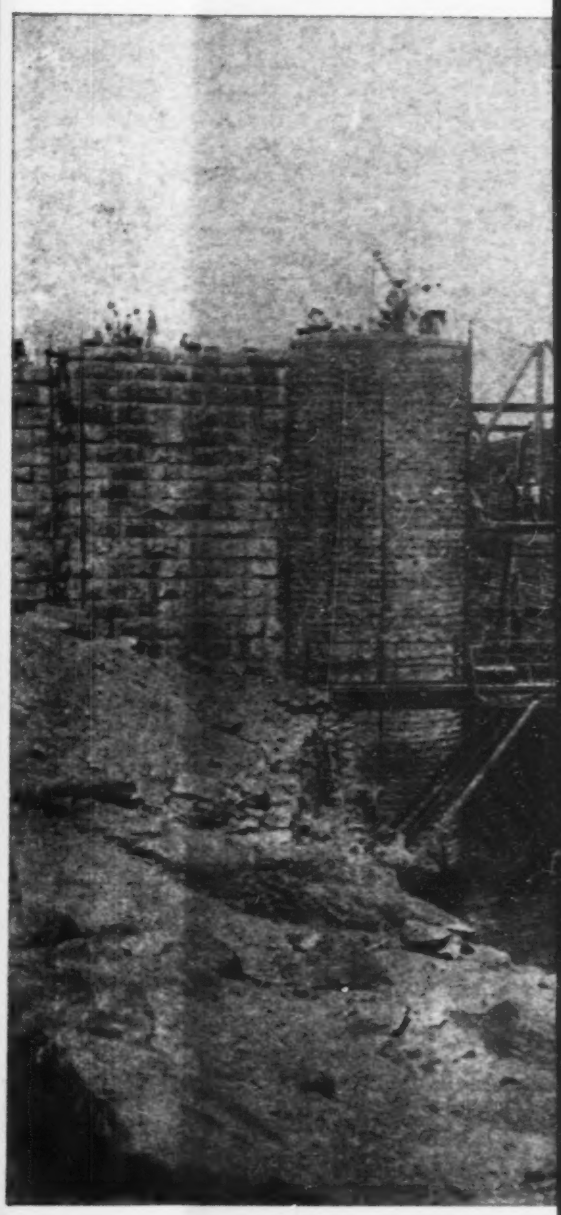
The main building, containing a basement and three floors above, one of which is in the roof, consists of a centre block facing east-south-east, with two symmetrical wings at a slightly obtuse angle, enclosing on three sides a terraced garden. To the east is a very large dining hall open on the south-south-east to a wide verandah, which is continued in an easterly direction to the chief doctor's house, forming a covered promenade about 65 metres, or say 200 ft. long. On the south side a long annex, with an enclosed verandah or gallery facing east, leads to another doctor's house containing the consulting-rooms, &c. On the west side of the gallery are the gardener's house, mortuary, &c. The total frontage in a straight line measures about 1,000ft. The sanatorium has accommodation for 120 patients of either sex, with seventy single and twenty-five double bedrooms, generally of a large cubic capacity. There are three main staircases. The staff consists of a medical superintendent with three assistants, and a managerial staff of four. The total staff, male and female, indoor and out, is ninety-two. There is one waiter to eight or ten patients. There is no regular staff of nurses, and no separate accommodation for them. They are only taken in if required by patients. There are only two slipper baths for patients and a douche-room in the basement. The water-closets are contained in the building. The floors of bedrooms are covered with linoleum; the walls are plastered. There are no rounded angles. The liegehallen are attached to the building, forming wide verandahs on the three sides of the terrace at the level of the basement floor, which is above ground on this side. In the grounds there are large open pavilions and smaller summer-houses containing couches, all fancifully and luxuriously appointed, and in the building are winter garden, reading, writing, billiard, and music-rooms. Altogether this is a high-class hotel, medically conducted, where wealthy patients

* Part of a paper by Mr. Edwin T. Hall, F.R.I.B.A., read before the Sanitary Institute Congress, Manchester, as mentioned on another page.

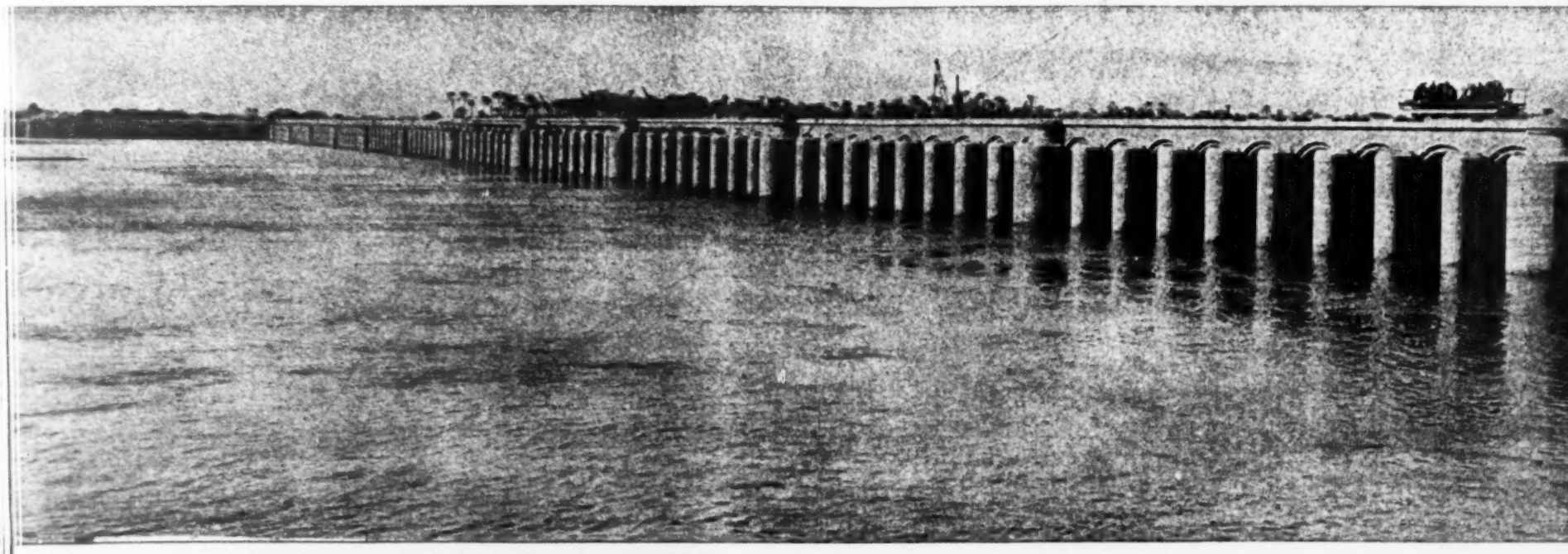




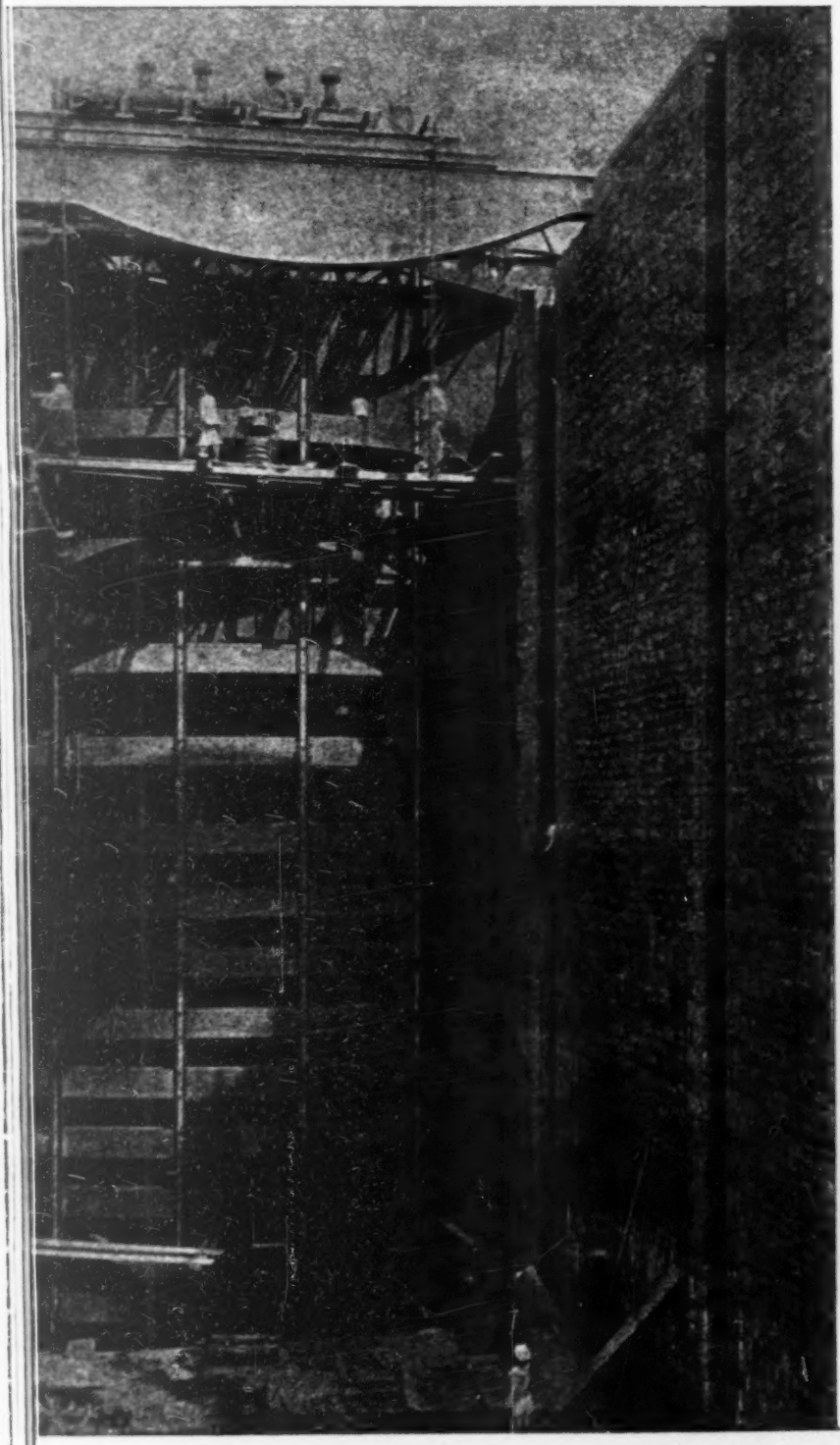
LOCK GATE, NAVIGATION CHANNEL.



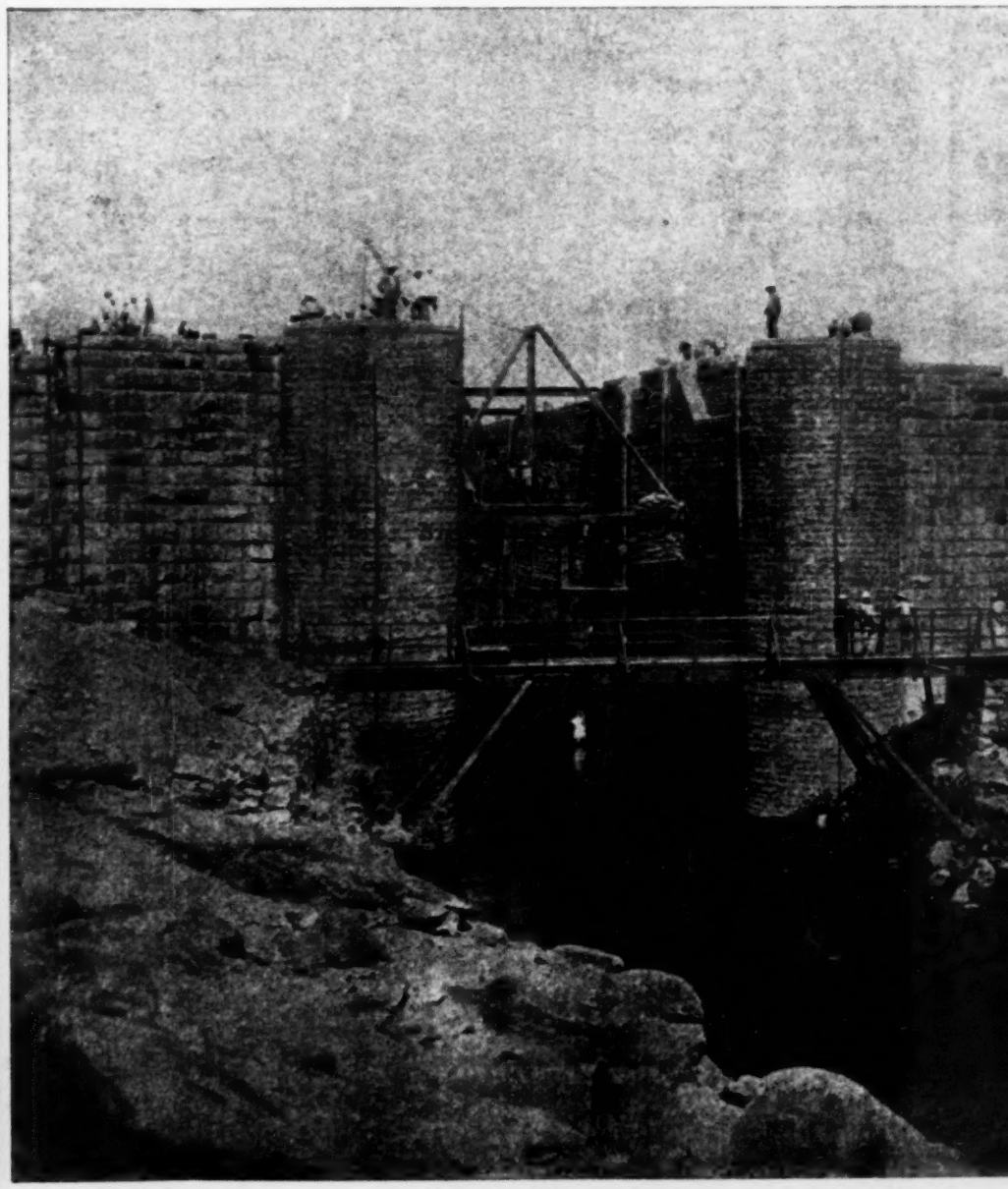
BARRAGE ACR



VIEW OF COMPLETED WORK.

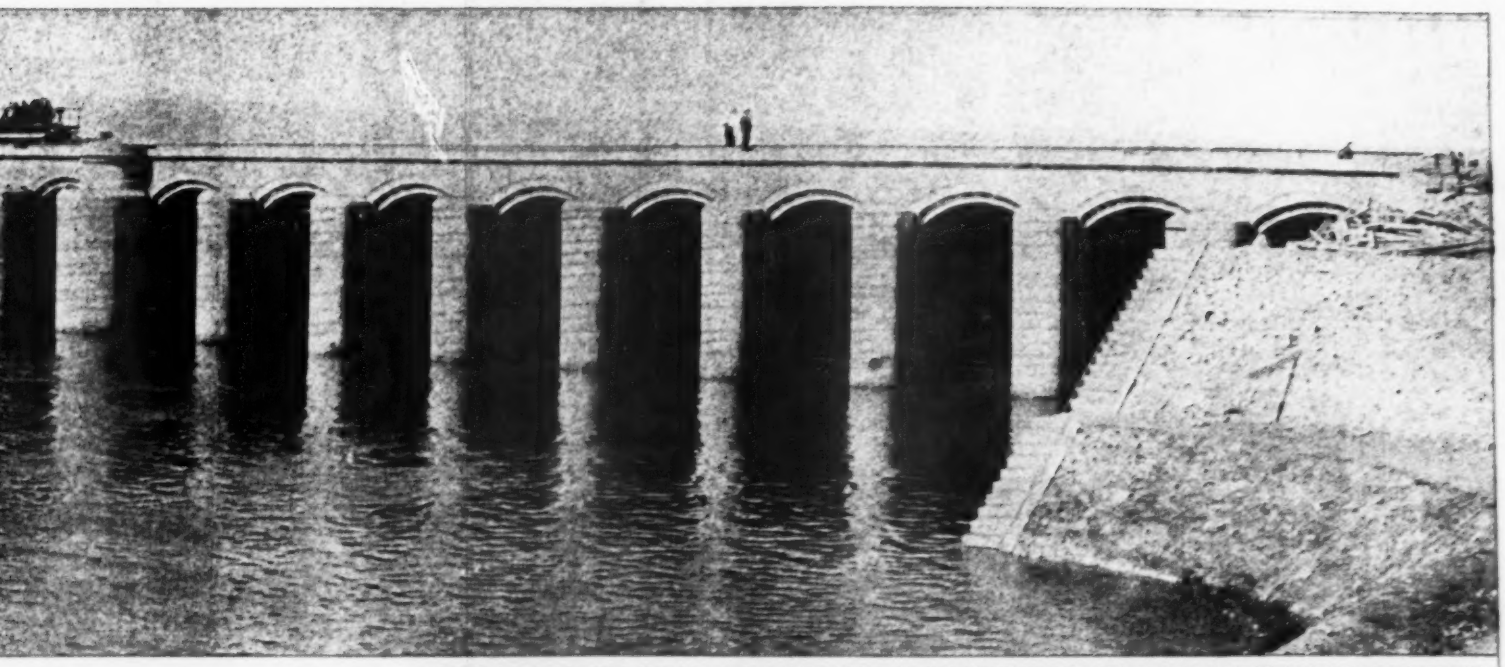


LOCK GATE, NAVIGATION CHANNEL.



NAVIGATION CHANNEL.

BARRAGE ACROSS THE NILE AT ASYÛT.



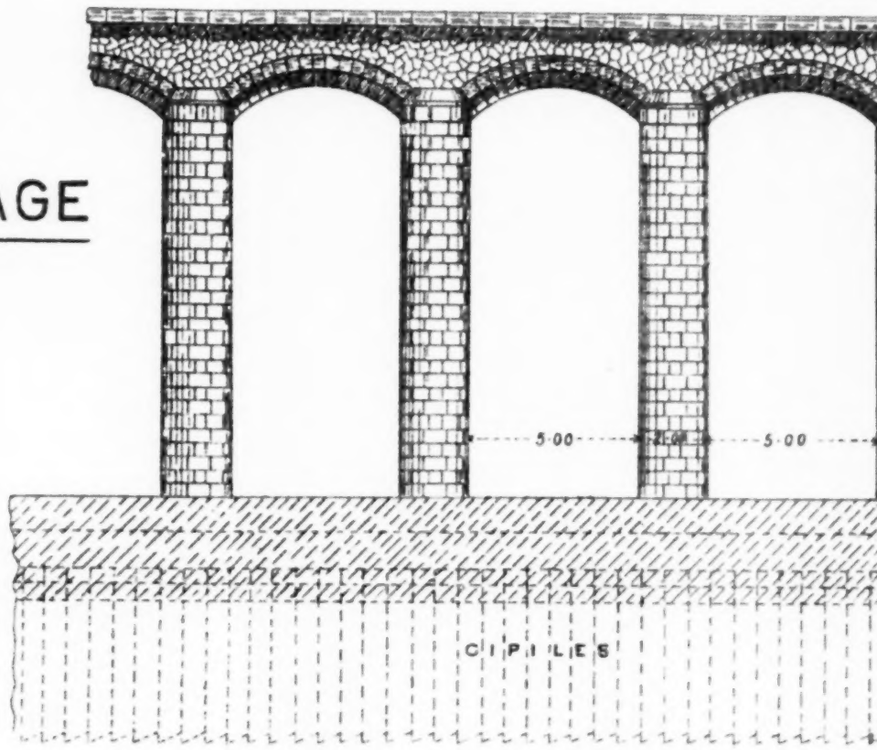
"IBEX-PHOTO" SPRAGUE & Cº LTD 4 & 5, EAST HARDING STREET FETTER LANE, E.C.

UNDERPINNING OF COLONNADE, PHILÆ.

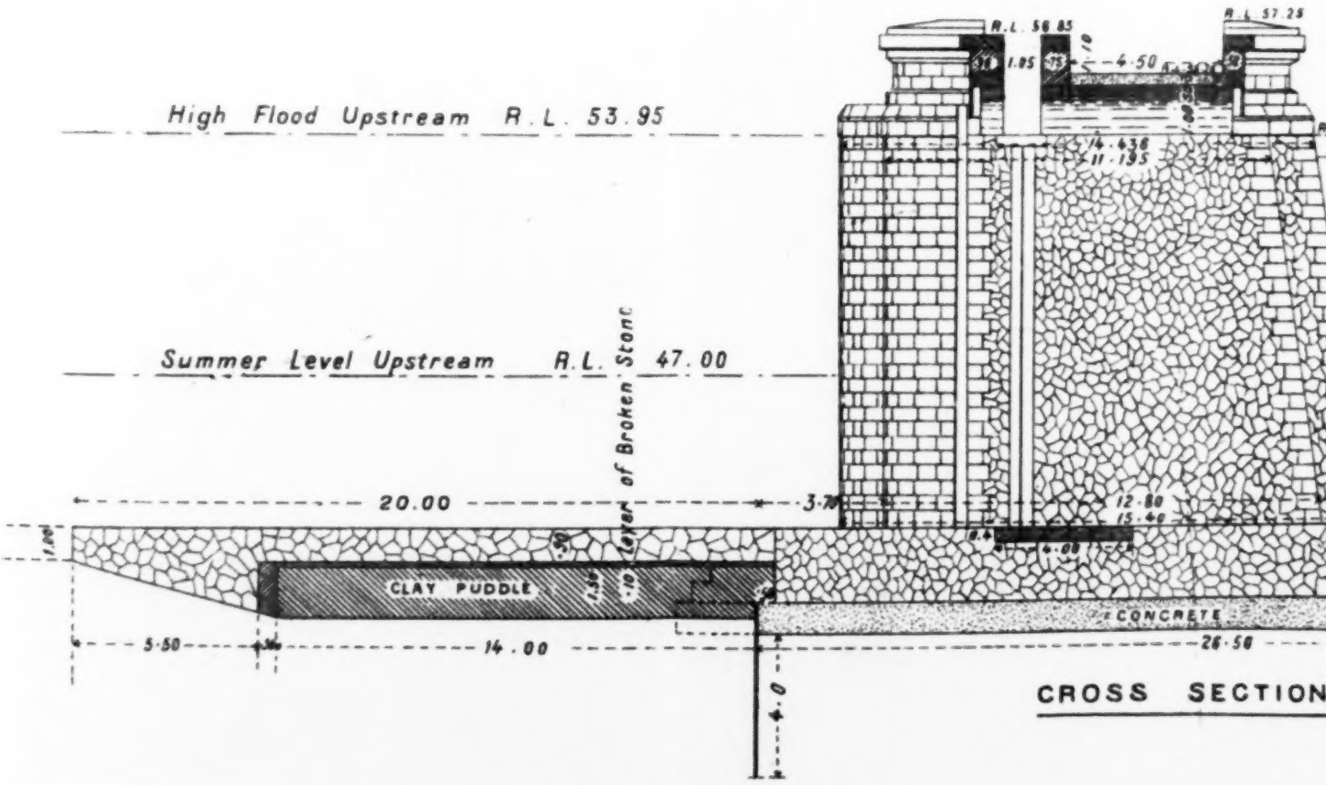
T.

ASYÛT BARRAGE

Scale = 1/200

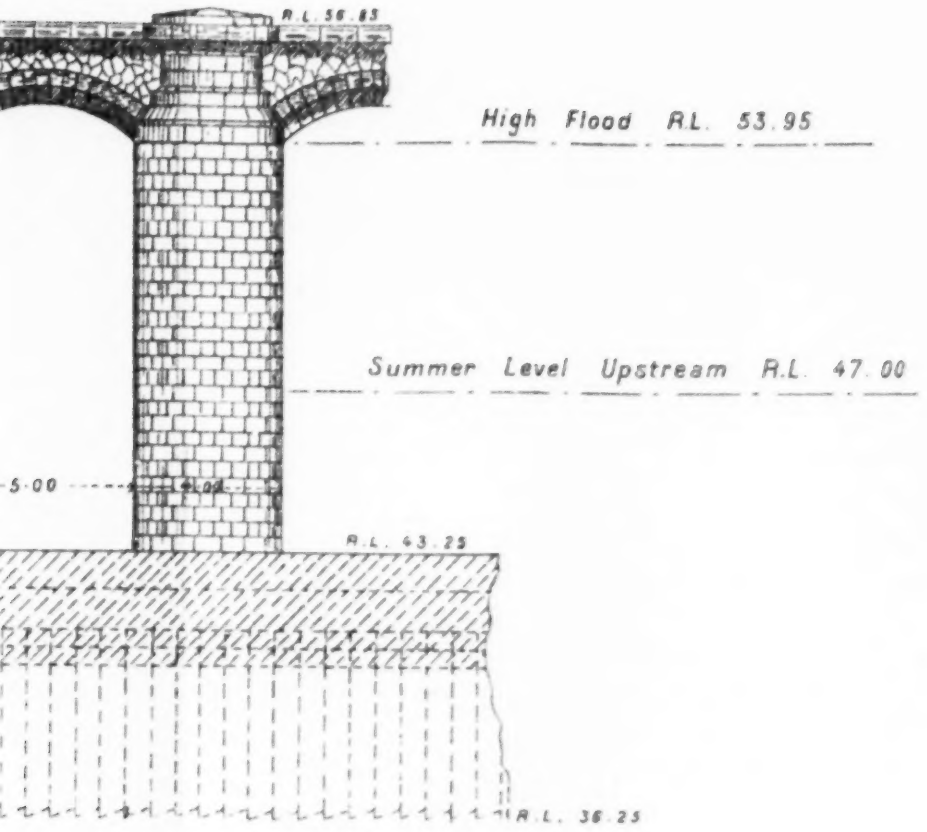


UPSTREAM ELEVATION

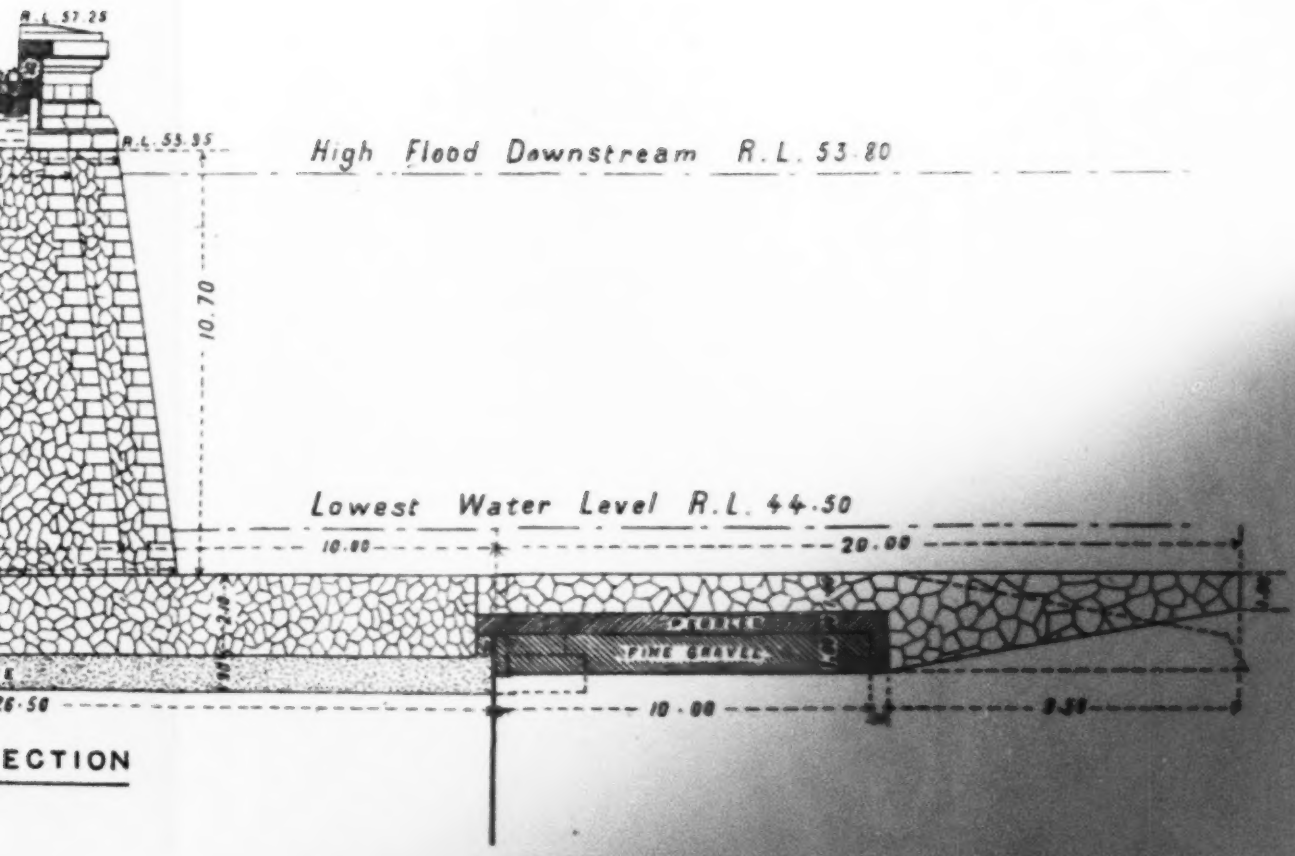


CROSS SECTION

BARRAGE ACROSS THE NILE AT ASYÛT ELE

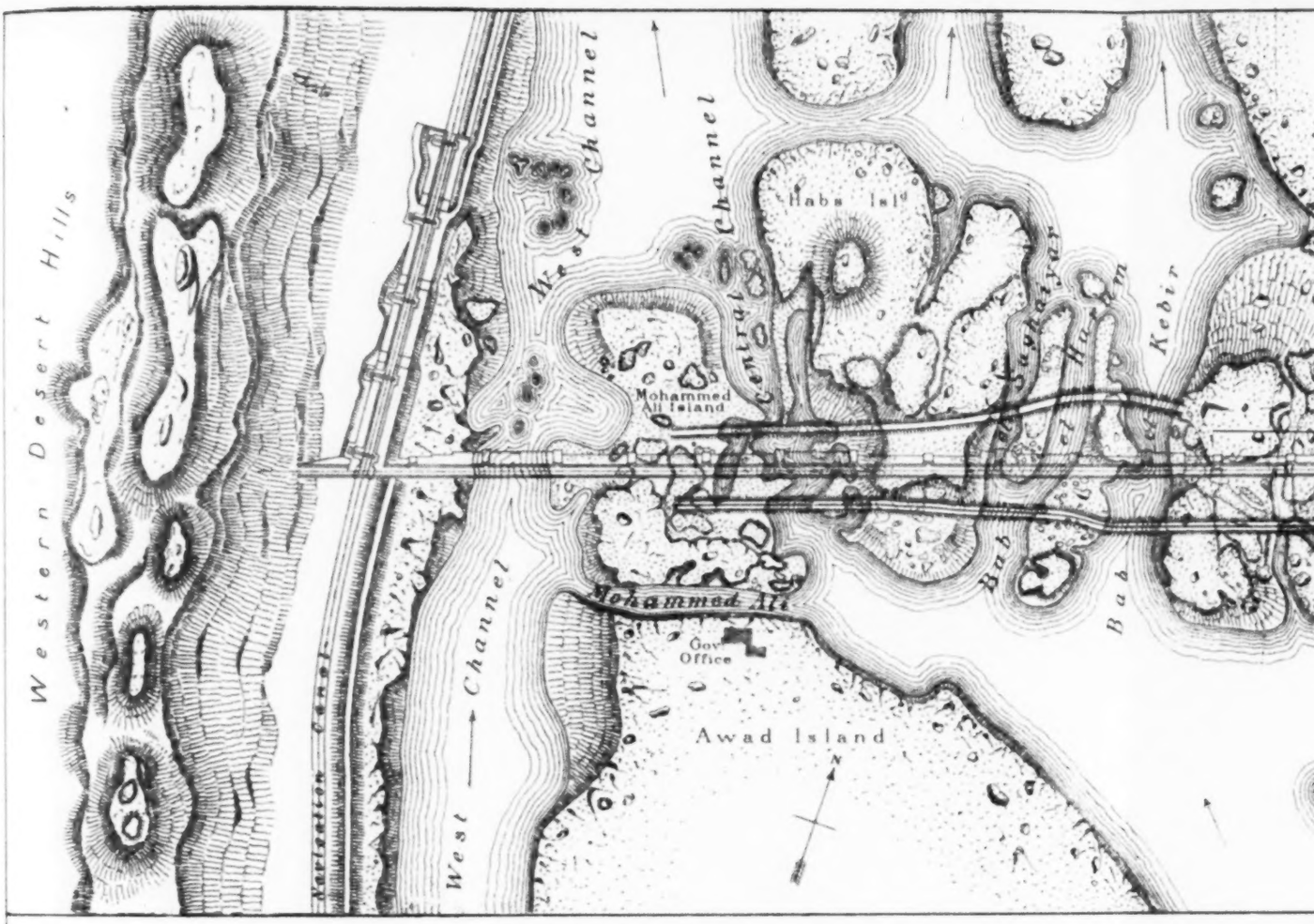


ON

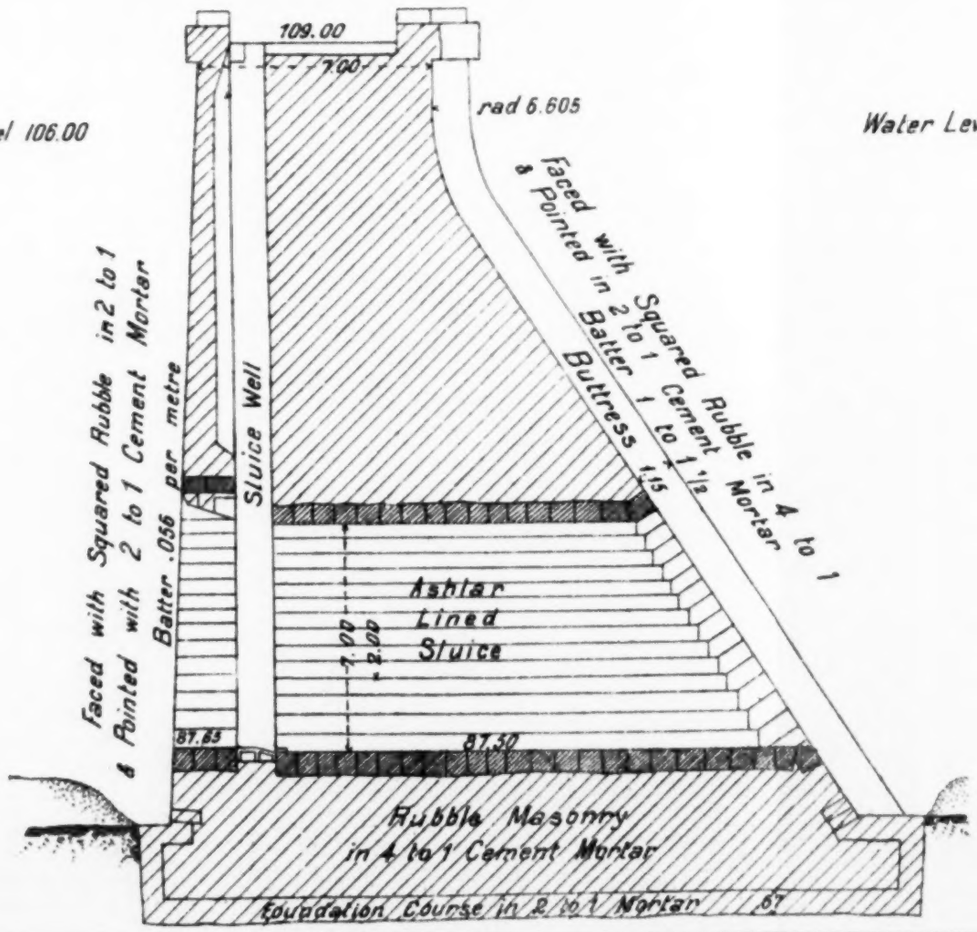


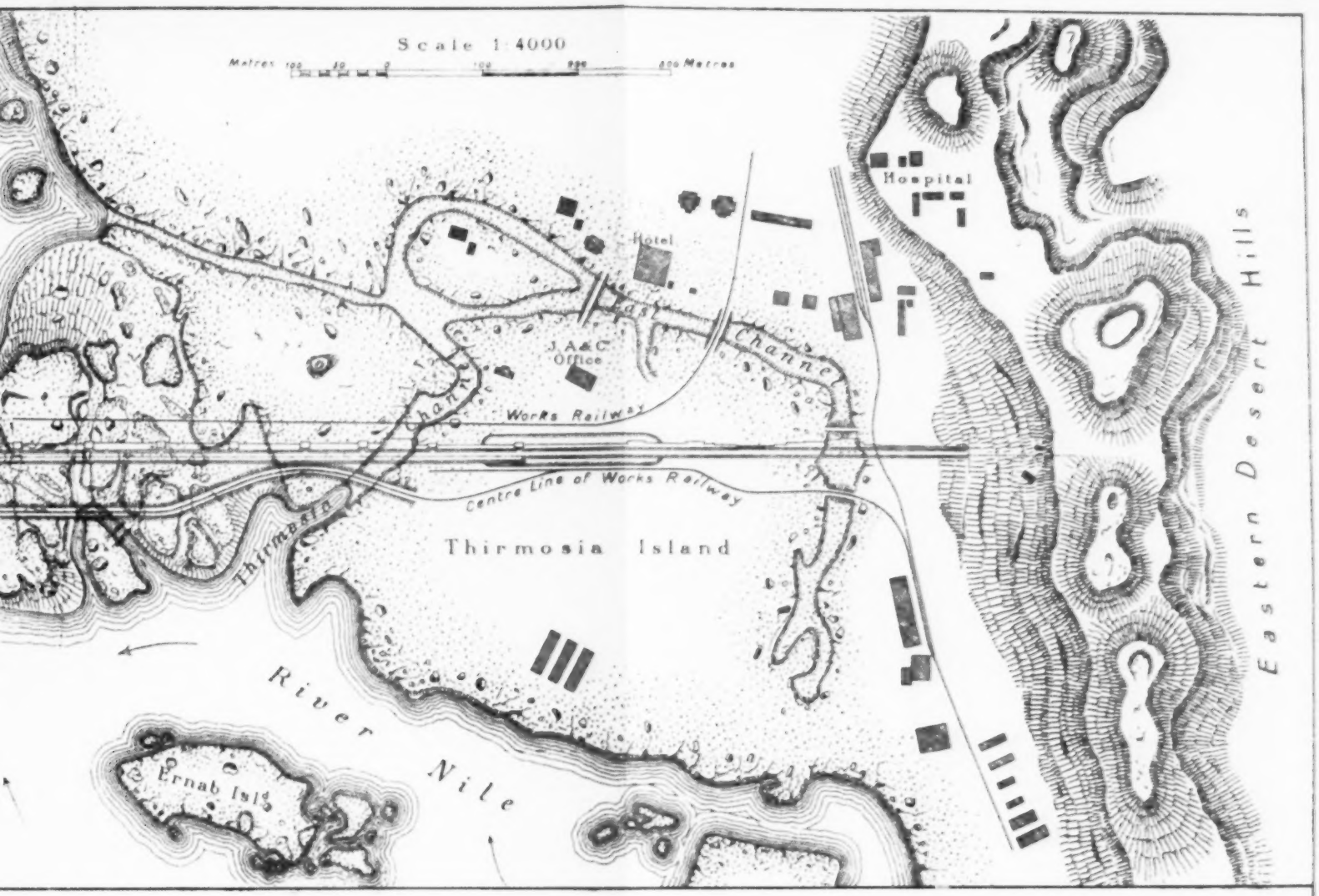
ECTION

YÛT ELEVATION AND SECTION



Section of Pierced Dam





Section of Solid Dam

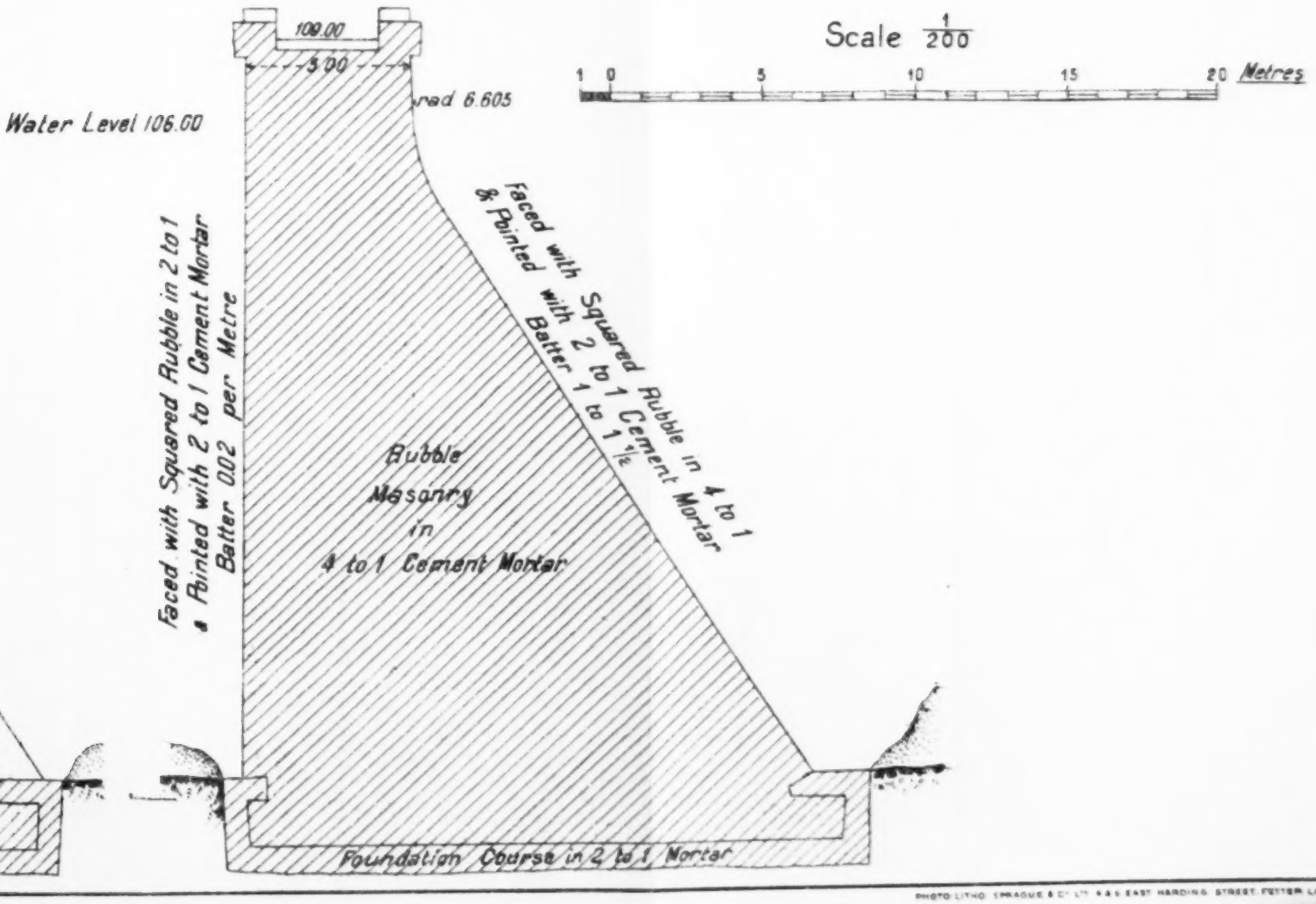
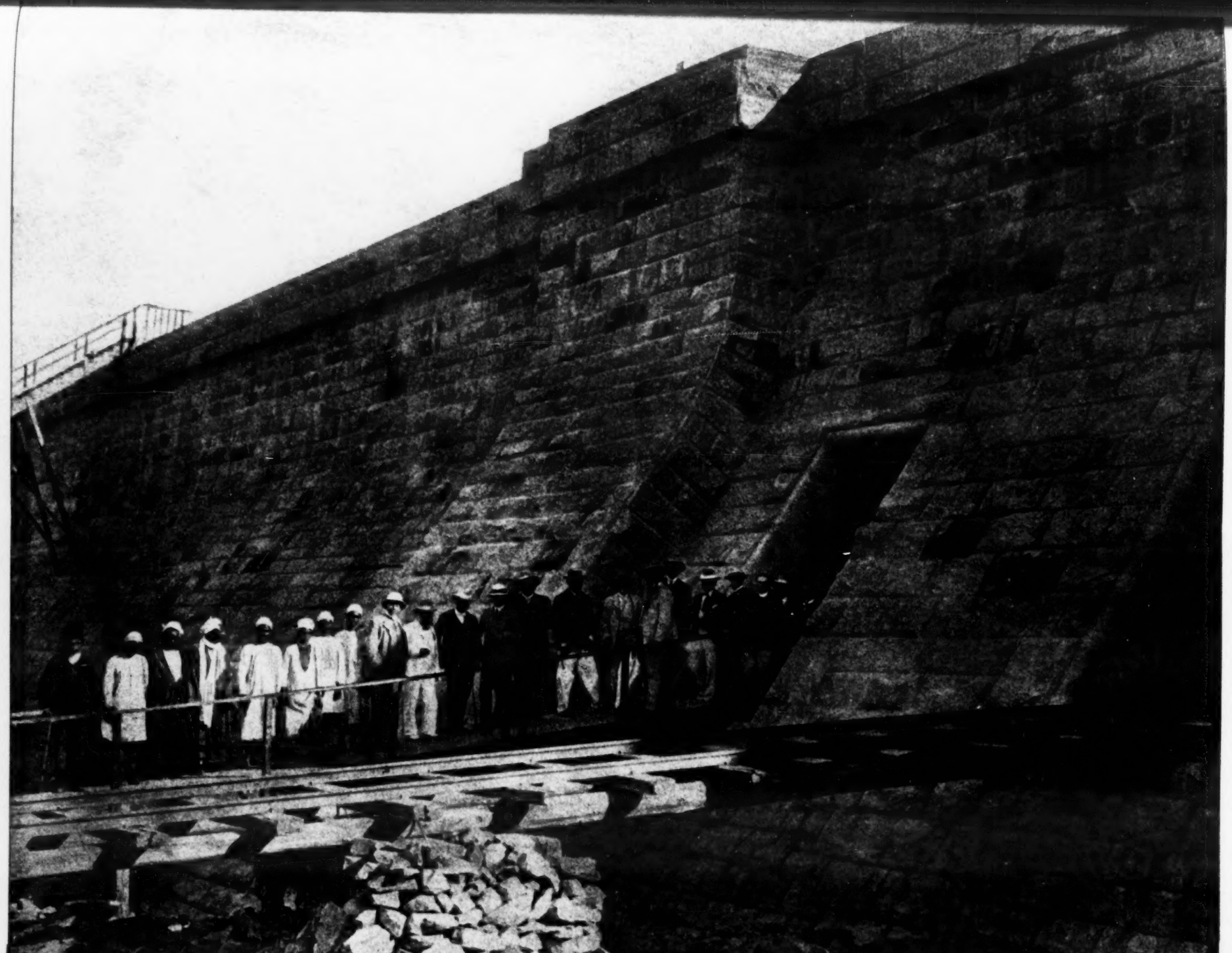
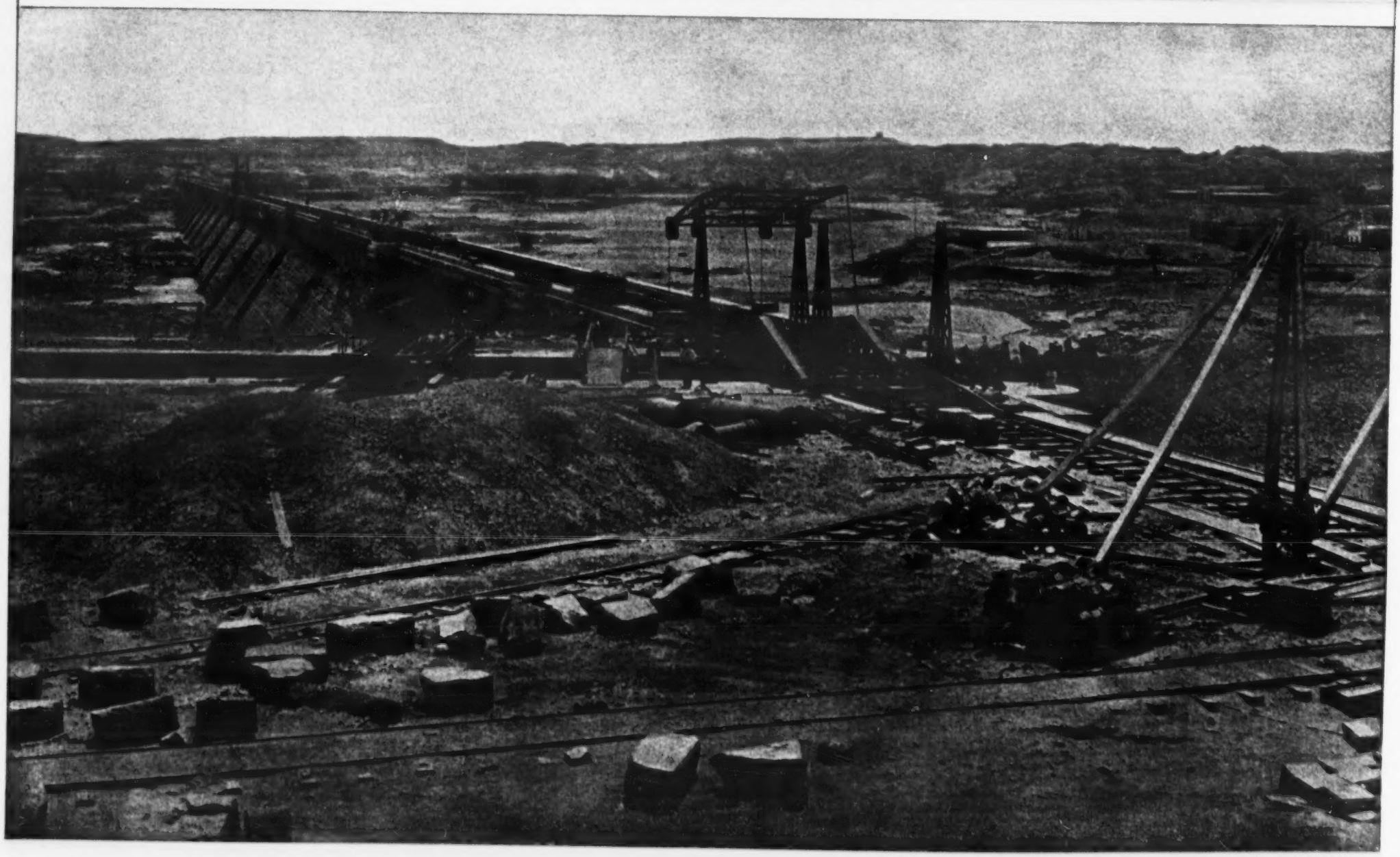

Scale 1/200
1 0 5 10 15 20 Metres
109.00
5.00
Water Level 106.00
Faced with Squared Rubble in 2 to 1 & Pointed with 2 to 1 Cement Mortar Batter 002 per Metre
Faced with Squared Rubble in 4 to 1 & Pointed with 2 to 1 Cement Mortar Batter 1 to 1 1/2
Rubble Masonry in 4 to 1 Cement Mortar
Foundation Course in 2 to 1 Mortar

PHOTO-LITHO. EMAGUE & Co. LTD. 44 & 45 EAST HARDING STREET, FETTER LANE, E.C.



PART OF DAM, SHOWING BUTTRESS AND SLUICE.



DAM IN PROCESS OF CONSTRUCTION: FROM WEST BANK, LOOKING EAST.

NILE RESERVOIR WORKS, ASWÂN.

may live cheerful lives in beautiful air and glorious scenery.

Ruppertshain, a few miles distant, near Königstein, is modern, is for poorer patients, and is more strictly a sanatorium. It is on plan a flat crescent three stories in height, above a basement, with two short wings, and accommodates 122 patients, ninety male, thirty-two female. There are no separate administrative buildings, but the kitchen is in the west wing on the ground floor. There are eighteen rooms with one bed, seventeen with four beds, and six with six beds, of a cubic capacity per patient for men of 20 mètres to 30 mètres, and for women of 30 mètres to 40 mètres. The staff consists of the medical superintendent, with two assistants, a secretary, and a lady superintendent or matron. There are three female and two male nurses, and twenty-four male and female servants. There are two main staircases from bottom to top. The patients' rooms face south, and are in single file, with a corridor on the north side. There are nine slipper baths for the patients, and one douche for each sex, all in the body of the building. The floors of bedrooms are of plain uncovered deal boards; the walls and ceilings are of plaster. In the older portion of the building there are no concave angles to the rooms, but in that most recently built all angles are concave except at the floor, where they are most needed. At the ends of the building there are two-storied liegehallen, about 12 ft. wide. The Nürnberg Heilstatte, Engelthal, a few miles from Henferfeld, is a modern building—a parallelogram consisting of basement, three other floors, and then rooms in the gables. There is no separate administrative block of buildings. It affords accommodation for fifty patients in seventeen rooms, two containing five beds, two with one bed, the others having three beds each. The cubic capacity per patient is 40 mètres. There is one staircase, which is not sufficient for so high a building with so many residents. All patients' rooms face south, and have a corridor on the north side. There is a medical superintendent, with no assistant. There are three female nurses and seven female servants. There are four slipper-baths and three douches, all in the body of the building. There are six water-closets for patients, similarly placed. A handsome dining-room faces south, and is served from the kitchen in the basement. The floors are of uncovered deal boards. Walls and ceilings are of plaster and have concave angles, except at floor, which omission the doctor laments. The plastered surfaces are artistically decorated, a feature which I commend to the notice of our hospital authorities. The liegehallen are quite detached, one being on the terrace at the south-west of the sanatorium, the other in the woods. The next building to describe is one of quite another type of plan. The Stadtisches Sanatorium at Harlaching is a few miles drive from Munich on the top of a hill, in a fir forest. This building may be described as a hospital. It is primarily for consumptives, but a few other cases of non-infectious character are received. They also make a speciality of dental surgery, and the dental operating room is fitted with every kind of the most modern dental appliances. Accommodation is provided for 212 patients, half of each sex, but the ultimate scheme is to add buildings so as to accommodate 600 patients. There is the medical superintendent and three assistant medical officers. The remaining staff consists of a manager, a legal clerk, a clerk, and one matron. There are twenty-one female nurses (members of a sisterhood), two male attendants. Of servants there are nine female and eight male, including engineering staff. The hospital is a building E-shaped on plan, three stories in height, with, I am glad to say, no basement rooms. Its main entrance frontage is towards the north. There are twenty-eight wards, six with twenty beds, six with twelve beds, twelve with single beds, and eight isolation rooms, each with one bed, but I think some of these last-named are appropriated for three bed wards. The cubic capacity per patient is 36·36 mètres. There are four staircases, two near the centre and one at each end, and one lift. The windows reach nearly to the ceiling. There are twelve slipper baths and three douches, two slipper and one douche at each extreme angle, all contained in one room divided by partitions. There are eighteen water-closets for patients badly arranged, each group of three with a slop-sink being placed in one room in the body of the building, with only one window. It is surprising to find such an arrangement in these modern buildings, an arrangement which the medical superintendents all condemn and lament. The aspect of the wards is as follows:—The twenty-bed wards are axially east and west, with windows north and south. On the south side of the wards, three stories high, are the liegehallen, about 12 ft. wide. Dr. Hermann thinks these very conveniently placed, but too wide, and owing to the fact that they are of solid masonry, arcuated on each floor, they keep off too much sun. Had they been 9 ft. wide, with pillar construction, they would, he thinks, have been admirable. There are other liegehallen in the grounds. The twelve-bed wards are north and south, with windows east and west. The single bed wards face east or west respectively, the isolation rooms north. The floors of the wards are of concrete covered with linoleum. Walls and ceilings are plastered. No angles are rounded, a fact of which the doctor complains. Ventilation when windows are closed is by means of warmed air inlet and by outlet shafts. Time is too short to allow me to describe these in detail. The fresh air is warmed by passing through a case containing a steam radiator, but Dr. Hermann, the medical superintendent, complains that the air so heated is too dry. To me this statement was interesting, because I have always had this objection to steam radiators for heating such inlets. The same result does not arise when hot water is used. The lighting is by electricity, and all the clocks are electric. The day accommodation for patients is excellent. There are two adjacent dining-rooms in the centre for the two sexes, looking into the large quadrangles, and a reading-room to the south of the dining-rooms. There are two handsome chapels, one for Roman Catholics, one for Protestants. The administrative block is north of the sanatorium. It is said to be sufficient for the ultimate scheme. The plan is very complete and admirable. There are, however, two points I venture to criticise, and these are:—1. Placing the linen-drying rooms over the wash-house and finishing room. 2. Placing the disinfector in the basement of the main block. The plan of the whole is a hollow square surrounding an open quadrangle. The south block contains the doctors' and priests' residences. On the south-west is the laundry; on the south-east are the kitchens, with dining-rooms attached for female staff, and the residences of the assistant matrons and nursing sisters. The west side contains the residence of the manager, servants, and engineer, and to the north of these the cow and pig stables, poultry-house, &c., with fodder lofts above. The east side contains the stables, coach-houses, &c. The boiler-house and engineer's department are in the centre of the quad. The main basement contains heating apparatus, disinfector, and very extensive cellarage. The cow stable is a regular feature at most of the sanatoria, and those I have seen are beautifully kept. The importance of pure milk is evidently fully recognised.

We turn to yet another type of plan in the Volksheilstatte Krailing, about half-an-hour's walk from Planegg, in Bavaria. The whole district is a forest, principally of pines, and the Volksheilstatte is beautifully placed, and seems the ideal abode of rest and seclusion. This is strictly a sanatorium for open-air treatment of men only. It receives 120 patients. There is a chief medical officer with two assistants. The matron does the correspondence, otherwise the institution is managed from Munich. There are twelve nursing sisters and three male attendants. There are twenty-one servants in all, male and female. The sanatorium contains a basement and three other stories. It consists of a central block with two wings at widely obtuse angles, and at the south-east and south-west intersections there are pretty chapels for Roman Catholics and Protestants respectively. There are patients' rooms containing 109 beds, thirteen rooms have single beds, fourteen have two beds, six have three beds, two have four beds, six have five, and two have six; but 120 patients can be accommodated if necessary. The cubic space in single bedrooms is fifty mètres, in other rooms from thirty to thirty-five mètres per patient. There are two staircases. The doors have fanlights, but not to the ceiling. All patients' rooms face south, and of the multi-bedded rooms there are four with side windows. There is an unobstructed corridor on the north side of the rooms in the wings. The kitchen is in the basement of the central block, the dining-room being on the ground floor on the south side, with a sitting-room adjacent. There are four slipper baths in one room on the ground floor, divided by curtains, and one douche-room. There are eighteen water-closets in groups of three arranged on each floor in one room in the heart of the building, with only one window. There is on each of the upper floors a room fitted with lavatory basins on both sides. In all there are thirty basins, the best accommodation I have seen in any sanatorium. The floors of all rooms are covered with linoleum. The walls and ceilings are of plaster with concave angles, except at floors, the omission of which is, of course, complained of. The patients' bedrooms are all on the first and second floors. The northern side of the ground floor of the west wing contains the matron's and nurses' rooms; that of the east wing the consulting-room, laboratory, doctors' bathroom, and the patients' baths. On the south of these are corridors, and south of these again are the liegehallen, about 3 mètres wide. These form a structural arcaded verandah beneath the patients bedrooms. There is also a liegehalle 78 mètres long in the woods, fitted with eighty couches. The medical officers' rooms are on the north side of the central block, with a committee-room on the first floor. At some distance east of the sanatorium is an administrative block connected by a subway. This block consists of basement and three other stories. It contains the boiler and engine-houses, disinfector, accumulator-room, laundry, stables for cows and horses, and residences for the remaining staff and female servants.

I conclude the description of German sanatoria with that of the Nordrach colony in the Black Forest, nine miles from the little station of Biberach. Here there is no sanatorium proper, but many small buildings dotted about the hillside. High up the hill to the left is the largest building, of three stories, containing rooms for twenty patients. It consists of a long centre, with two short wings at obtuse angles of some 190 deg., so that they face to the south-south-east and south-south-west. At the intersection of the angles are hexagonal turrets. There are two staircases. In this building, as in the others, each patient has a separate bedroom of about 50 cubic mètres capacity. All have single casements with fanlights, which latter are hung at the top and open outwards. There are balconies to some of the rooms. Each bedroom is fitted with a douche-bath supplied with hot and cold water. There are only two slipper-baths altogether, and these are solely used for medical purposes. There is one water-closet for every ten patients placed within the building. The floors are of wood covered with linoleum. The walls and ceilings are of narrow boards, beaded not only at the edges but on the solid parts, and there is a moulded wooden cornice. There are no concave angles. It is strange that all canons of smooth surfaces and rounded angles are here set at naught. The explanation probably is that there is no dust in the place. I have before noted that each bedroom is fitted with two lavatory basins, one for washing, one for sputum. There are a few ordinary summer-houses in the grounds. Another building of two stories is provided for sixteen patients, and the rooms are only about 8 ft. high. It is not only electrically lighted, but heated by electric radiators of the doctor's own manufacture. The medical staff consists of Dr. Walthers and another physician of equal standing. There is a secretary. There are no nurses as such, the doctor holding that nursing, as we know it, "ought to be done by the medical men." There are two female servants to every ten bedrooms. In parenthesis it may be interesting to know that Dr. Walthers strongly objects to the plenum system of ventilation, about which we have lately heard a good deal, of which he has had experience. There are various other buildings forming the colony, dotted about here and there. Among them is the doctor's house, with the sitting-room made so that in the summer one external wall or enclosure can be completely removed. It will be seen from the foregoing that Nordaerh has nothing of the structural sanatorium about it. It is a hamlet on a mountain side, "far from the madding crowd." Nature provides varied refreshment for the body and mind.

It may now be of interest to briefly describe a few modern English institutions. I have had the pleasure of visiting the sanatorium near Crookesbury Ridges, under the direction of Dr. J. Rufenacht Walters. The sanatorium consists of two one-storied pavilions, one of eight and one of twelve single bedrooms, facing south, all with French casement windows opening on to a verandah, canvas covered, for reclining couches; corridors run the whole length behind the rooms. There are two nurses living in the buildings and one masseuse. The cubic capacity of the rooms per patient is about 1,100 ft. The floors are of wood covered with linoleum. The walls and ceilings are of plaster with slightly concave angles. The ventilation is by the windows, by inlet tubes, and by shafts at ceiling level across the corridor to the north. In the newer eight-bed block there are fanlights to the doors, so that all the room may be scoured with air. There are four bathrooms, two having needle-baths. The dining-room is attached to the older pavilion opening from the corridor, and beyond it are the kitchen and offices. The heating is by hot-water radiators. The lighting is by electricity.

A larger institution is that called Pinewood, at Wokingham. This has accommodation for sixty-four patients, each in a single bedroom of an average cubic capacity of 1,100 ft. The institution consists of a central block of three stories, containing the consulting-rooms, offices, and dispensary, with residences for the medical staff above. Detached from this on either hand is a patients' block of two stories, each block containing thirty-two single bedrooms. These blocks face south-south-east and south-south-west, and each has a corridor on the inner or northern side. There is one staircase in each. The ground-floor walls are of brick; the first floor is enclosed by wood framing covered with boards and tiles. There is one resident nurse in each block. The douche and slipper-bath rooms and water-closets are on the north side of the corridor, and open directly from it. The windows are single casements, which do not reach the ceiling. The doors have no fanlights. There are no verandahs or balconies. The floors are boarded and covered with linoleum. Walls and ceilings are of plaster. There are concave angles, except to floors, where angle fillets are fixed. The heating of rooms is by open fires, that of corridors by hot water radiators. Lighting is by electricity. The administrative block is detached to the north; it contains a handsome dining-room, with service and nurses' rooms attached, kitchen and offices (with female staff bedrooms over), and other rooms adjacent. There is a laundry block with disinfector, an engine-house, stables, &c.

I may now perhaps describe a sanatorium which the Brompton Consumptive Hospital is erecting at Frimley, in Surrey, from my designs. It is to accommodate 100 patients, and, unlike the others, it is for non-paying inmates. The site is high, and well wooded with fir trees. There are forty-eight single bedrooms, eight with two beds and twelve with three beds. Every patient's room will face S., S.S.E., or S.S.W. Outside the central block is a wide paved terrace. It will be noted that we have provided a large number of single bedrooms, and in other rooms have fixed our maximum at three beds. Many of the German doctors with whom I have discussed the question favour this as the maximum. The sanatorium proper, or patients' block, consists of a central building three stories high, with four radial wings or pavilions two stories high, all built of brick, the upper story tile hung on the brick, the roof being also tile covered. All wings are practically detached, and in a pine country this tends to limit the risks of fire and consequent danger to patients. By this arrangement of plan any one floor of the two or four wings may be appropriated to women, leaving the others for men; each group is self-contained, with its separate sanitary conveniences. This plan also affords much greater facilities for classification than could be found in one building of the ordinary type. The main entrance hall is in the centre, and behind it is a dayroom facing south, with two three-bed wards at the sides. East and west of the hall are the consulting and matron's rooms, dispensary, and sister's duty-room. The first floor has similar patients' and sisters' accommodation, a committee-room, a residence for the matron, rooms for the sisters, and a maid's room. Overhead, in the roof, are bed-rooms, &c., for female servants, with their bathrooms, &c. The pavilions are connected to the centre by enclosed corridors having windows on both sides. Each wing contains twenty-two beds. The corridor on the north side has no obstruction whatever to light and air. Opposite every room door there is a window in the corridor, and as all doors have fanlights carried, like the windows, to the ceiling, we shall get through ventilation, and even on hot sultry days the cooler air on the north side of the building will induce a current to the hotter south side. The windows are casements, those on the ground floor opening to the floor so that, if necessary, beds may be wheeled ont. The casements on the ground floor are so constructed as to keep out rats and other vermin, while the windows may remain wide open. On the first floor there will be outside jalousie shutters, which can be closed either to exclude rain or intense sun heat, the windows remaining open. On the ground floor rolling canvas blinds, like those over shops, will effect not only the same purpose, but will shelter beds or couches outside. By this means we get the advantages of a verandah without any of its drawbacks. On each floor are large linen-rooms, and on the ground floor are boot-rooms. Between each pair of pavilions is a sanitary tower, detached except for a cross-ventilated lobby. This contains all the patients' water-closets, baths, lavatories, and housemaids' closets. For the nursing staff on duty separate ward kitchens, lavatories, and water-closets are provided on both floors. There are separate entrances to each pair of pavilions, two main staircases, and at the outer end of each pavilion a fire-escape staircase. The heating generally will be by hot water, the lighting by electricity. The floors will be of wood covered with linoleum, and all walls and ceilings will be of plaster with concave angles everywhere. To the north of the sanatorium proper are the two patients' dining-rooms and a general assembly hall. Behind are the kitchen block, female servants' hall, men's room, &c. At the east end is the nurses' home, at the west the medical officers' and men servants' residence. Nearer the main road are the laundry, boiler, and electrical engine houses, electrical ambulance house, mortuary and gate lodge. There are two laboratories.

Lastly, may I be permitted to refer to the new Camberwell Infirmary in course of erection from my designs. There will be 800 beds in the institution. My reason for mentioning it here is, that the Board of Guardians have, on the advice of the medical superintendent, Dr. Keats, and myself, made special provision for tuberculosis patients. We have three large wards of twenty-four beds each, in which practically the whole length of the walls on three sides are made to open, so that the patients may be said to lie in the open air, and above the wards are flat roofs with easy access, so that some patients can be actually in the open air all day long.

THE PROVISION AND CONSTRUCTION OF SANATORIA FOR PULMONARY TUBERCULOSIS.*

AN ideal sanatorium cannot be designed on a cramped site, and not only should the site be ample enough to allow the buildings to be arranged to the best possible advantage, but there should also be grass land around to ensure the absence of dust, and to afford room for walks and exercise. A sanatorium for consumption must be considered as a specially designed hospital in which an infectious disease is to be treated.

"In order to facilitate the maintenance of healthy conditions in a hospital the form of the building should be such as to ensure the provision and proper application of (1) fresh air, with the necessary warmth and coolness; (2) ample light, including the penetration of sunlight to every part; (3) purification of floors and walls."

These words of Sir Douglas Galton will apply with even greater force to sanatoria, and in an ideal building the following requirements are essential:—(*a*) Free play of sunlight upon each room and block of buildings provided for the patients' accommodation. (*b*) The freest possible circulation of air around each building, and the avoidance of all enclosed spaces in which air would be liable to become stagnant. (*c*) Ample space between the various buildings. (*d*) Facilities for enabling the patients to spend the greater part of each day in the open air. (*e*) Sufficient compactness of plan to allow of all departments being placed within reasonable distance of the administrative centre, which should be separated from the patients' quarters. (*f*) Isolation of the engine and boiler-house, the laundry, mortuary, and other subsidiary buildings. (*g*) Departmental separation of male and female patients, whose quarters and exercise grounds should be placed on either side of a central administrative block.

The best type of sanatorium for small numbers probably is one built on the village system, in which the patients live in detached chalets, which are grouped around a central administrative block. Not only is free circulation of air and light promoted, but there is no institution look about the place. The patients feel more at home, and scarcely realise that they are in a hospital. But such a plan is not the best for a sanatorium containing 100 or more patients, as the labour of supervision and administration in a public institution consisting of a multitude of detached units, together with the expense of maintenance, would be prohibitive. A compromise may be effected by planning a series of pavilions, each consisting of a one-storied row of single rooms, completely surrounded by a verandah, with their long axes radiating from the central administrative block with which they are connected by a wide open corridor. Such a sanatorium has all the advantages of free circulation of air and light which the sanatorium of the "village" type possesses, while it is as easily administered and supervised as a large hotel.

The drawings which we exhibit to-day constitute an attempt to design a sanatorium of this type, to give accommodation to eighty-eight patients of the usual hospital class, and to twelve paying patients who require better accommodation. Provision has been made for an administrative block, arranged with the object of interfering as little as possible with the free circulation of air and sunshine. The front is two stories in height, and has a southern aspect. Behind this building is a long range of one-storied buildings, the principal rooms of which are lighted by lantern lights in addition to the usual side windows. The boiler house, laundry, &c., forming the centre of the semi-circular plan, are placed at the extreme north end of the central block. Then pavilions containing sleeping rooms radiate on either side, and an open corridor connects them with one another and with the administrative building. Twelve separate chalets for the accommodation of better class patients are placed between the pavilions and the front administrative building. The stereotyped design seen in so many asylums and hospitals has been carefully avoided. A good æsthetic result may be obtained without the employment of costly stone quoins, cornices, and so-called enrichments. The bungalow type of building appears to be the best for our purpose, and the elevations conform to the plan. Without going into detail we may say that in a sanatorium all the usual precautions against dirt and dust, such as rounded corners, hard impermeable walls, terrazzo or teak flooring would be required.

In the front administrative block on the ground floor spacious dining, drawing, reading, and recreation rooms for the use of the better class patients open into a large central hall. On the first floor are bedrooms for the matron and nurses, and on the attic floor, approached by separate staircases, sleeping accommodation is provided for the servants of either sex. The kitchen occupies a central position between the dining-rooms allotted (*a*) to the patients, (*b*) to the nurses, and to the servants. An extraction fan placed in a large lantern light ensures thorough ventilation, and in order to obviate the possibility of any cooking fumes permeating into the adjacent passages, it is approached through well-ventilated lobbies, placed at either end, and forming the necessary serving rooms in connexion with the kitchen. On either side are the necessary provision and store rooms, and surrounding the building in front is a wide covered verandah, which is prolonged on either side into a raised terrace. On the west side an annexe is provided for medical work. This comprises patients' waiting and dressing rooms, consulting room, and an inner room for physical diagnosis. On the opposite side of a central passage are the laboratories, together

* Part of a paper by Mr. A. W. S. Cross, B.A. Cantab., F.R.I.B.A., and Mr. A. G. Walsford, M.D., read before the Sanitary Institute Congress at Manchester.

with a dark room and an animal room. Overlooking the terrace are rooms for an assistant medical officer, and the dispensary and general office. On the east side a corresponding annexe contains the nurses' dining and day rooms. Dining-rooms for the patients and servants, recreation-rooms, including a library, a large winter garden and a chapel are provided in the main central block. The main corridor is centrally placed, and connects the pavilions with one another. This corridor, open at the sides, is on the same level as that of the floors of the pavilions, and beneath it is a subway for pipes, &c. On either side of the administrative buildings three separate pavilions, each containing fifteen rooms, are placed with their long axes radiating from the centre of the plan, and planned as separate and independent blocks, communicating by an open covered way, with the main corridor. Each room is provided with an open fireplace. Each pavilion is surrounded by a wide verandah, and the rooms open on to it by French windows or doors, which, to prevent direct draught, may be double, as efficient ventilation is assured by windows consisting of fixed glass louvres above the verandah roof. As these cannot be closed constant and efficient ventilation is provided without the use of pipes and tubes which collect dust, and are often worse than useless. Outside the windows, jalousie framed shutters are provided for use in very boisterous weather. The verandah is enclosed with glass at one end, to form a sunroom, but with this exception it is entirely open, and, unless the weather were very inclement, the windows of the sunroom would be always open. The verandah roof is glazed with thick unpolished plate glass, through which the sun's rays will not penetrate with full force. Each room has a floor area of 15 ft. by 12 ft., and a clear height of 14 ft. This gives a cubic capacity for each patient of more than 2,500 ft. Each pavilion practically consists of a row of one-roomed chalets, the verandahs of which communicate. This gives the opportunity to patients to obtain the full benefit of the open-air treatment as regards sunshine and fresh air. The better class patients are housed in separate chalets. Between the pavilions and the main building is a building containing a douche room, and a room in which special inhalations can be given. A glass room for the sun-bath treatment is provided. Fronting the main back road is a detached building containing the boiler-house, pumproom, the laundry, and the disinfector and destructor. Surrounding the boiler-house and laundry block is a wide road for vehicular traffic, in connexion with which is a branch inclined roadway, leading to a subway connecting the back with the front of the administrative buildings. The subway runs from north to south, and is of sufficient width to allow of a trolley service for the carriage of coals and provisions which would be brought in at the back entrance and conveyed to the kitchen. The open corridors afford ready access to all parts of the sanatorium without interfering with the circulation of air. The principal medical officer's house is within easy reach of the sanatorium, but separate from it. The grounds would be laid out with covered and open, level and inclined, paths, and with the usual desiderata of a well-appointed sanatorium, into the details of which we cannot enter now.

ASSOCIATION OF MUNICIPAL AND COUNTY ENGINEERS.

A YORKSHIRE district meeting of the members of the Incorporated Association of Municipal and County Engineers was held at the Council Offices at Shipley, on Saturday, September 13.

The President (Mr. T. H. Yabbicom, C.E., of Bristol) occupied the chair, and among those present were Messrs. A. D. Greatorex, West Bromwich; T. Cole, London (Secretary); W. H. Hopkinson, Keighley; C. F. Wike, Sheffield; J. H. Williams, Burnley; T. Kidd, Swadlincote; S. Edmondson, Burnley; S. Turner, Knaresborough; T. Scott, Tadcaster; A. S. West, Harrogate; E. J. Silcock, Leeds; C. Lund, Cleckheaton; E. R. S. Escott, Halifax; G. Fitton, Basingstoke; J. R. Wakeford, Bilston; and others.

Councillor Shaw, Chairman of the Council, received and welcomed the members and expressed his pleasure at receiving the Association.

The President acknowledged the welcome accorded to the Association. He believed their meetings were of mutual advantage to surveyors and to the authorities they represented.

Mr. W. H. Hopkinson, Borough Engineer, Keighley, was unanimously re-elected Honorary Secretary for the Yorkshire district.

Mr. I. Lindow, Clerk of the Council, presented a paper on the municipal works at Shipley. He prefaced the paper with an explanation that it was a journalistic effort, a collection of facts rather than an expert review of the works of the district. The town had been practically remodelled, but the heavy expenditure which had been incurred on street improvement work had abundantly justified itself, in that it had without doubt materially contributed to the progress of the district. It might fairly be claimed that the town was now generally provided with good wide sanitary streets, and that "slum" property, in the sense generally understood by that expression, was practically non-existent. Public needs and requirements had been provided for by an efficient scheme of water-works, a thorough system of drainage with outfall and purification works, public cemetery of twenty acres, isolation hospital, parks, modern public abattoirs, fire brigade, whilst the District Council had recently added, as part of the municipal works, the acquirements of the gasworks, the municipalisation of the Salt schools, and the institution of an electrical supply station for traction, lighting, and motor-power purposes. These works had been and were being carried out under three Acts of Parliament and seventy-five Provisional Orders, and sanctions for loans amounting in the aggregate to 751,281*l*. The growth of the district was shown by the following figures:—The population, which in 1881 was 15,089, was now over 29,000, whilst the rateable value in the same period had advanced from 68,000*l*. to over 108,000*l*. In the year 1853 Shipley was constituted a Local Government district under the Public Health Act, 1848, and in the following year the authority obtained the Shipley Waterworks Act, empowering them to construct waterworks, and thus giving them the right to supply what had now become a very large consumption of water. Further powers were obtained in an Act of 1874, and the storage reservoirs were increased to the extent of 95,000,000 gallons, so that at present, with a storage capacity of nearly 140,000,000 gallons, Shipley was provided with a storage equal (apart from compensation water) to 120 days' supply. The gathering grounds, which comprise an area of over 2,000 acres, formed part of the far-famed Rombalds Moor common lands. Shipley people were extravagant users of water, the consumption per head of the population being over 30 gallons per day;* and whereas the receipts from water used for domestic purposes had increased over 20 per cent. during the past seven years, the income for trade consumption had actually gone down. In an industrial centre such as Shipley this was no doubt exceptional; but it was due to the circumstance that manufacturers had availed themselves of the facilities for obtaining water from the canal and the river, and also by means of wells, the valley in which Shipley was situated providing a good supply of water for dyeing and other trade purposes. The want of elasticity in the income from water prevented the rates being benefited from that source, but the Council were enabled to encourage the use of water for sanitary purposes. In another sense the Shipley consumers had a right to congratulate themselves, because, whereas in most towns there was an extra charge made for baths and water-closets, householders in Shipley were entitled to one bath and one water-closet free, no extra charge being made for these on the ordinary scale charge for domestic purposes. It might be argued with some show of reason that free baths and water-closets were unfair to those consumers who had no such privileges, and who had therefore to accept the burden of providing for their more fortunate neighbours. An important consideration, however, was the encouragement which it gave builders to make healthy sanitary provisions, and new houses without baths and water-closets were now the exception. The expenditure on waterworks account had been 125,000*l*. Shipley was provided with a thorough system of drainage, both in regard to street drains and main outfall sewers, though the complete interception had not yet been carried out. The early adoption of an expensive street improvement scheme got rid of a considerable area of old property, paved the way for the provision of wide streets, both at the back and front of dwelling-houses, and led to the adoption of stringent by-laws, striking testimony to the benefit of which was afforded by the wide, healthy thoroughfares to be found in the district. During the past ten years there had been over 1,000 houses erected in the district, of which not more than a score had been provided with the common privies. Whilst insisting on thorough drainage to the houses, the Council had also had before them the necessity of the gradual removal of the common privies, and the substitution therefor of waste-water closets or the ordinary water-closets flushed from the town's mains. Within the last five years about 1,000 common privies had been converted into water-closets, the most notable instance of this conversion in the district being the "model village" of Saltaire, which was built over forty years ago on what was then considered an admirable principle. But the streets were narrow, and the old privies a constant nuisance and danger to health. To the credit of the Saltaire firm (Sir Titus Salt, Bart., Sons, & Co., Ltd.), they resolved to carry out a privy conversion scheme for the whole of their 800 houses. This scheme entailed a very heavy cost, but the benefit was to be seen in the improved health of the community, and sweeter surroundings of the dwellings. The example set by this firm was being followed pretty generally, and the authority had not met with much disinclination on the part of owners to get rid of the old insanitary conditions. This improvement had also enabled the Council to deal more effectively with another department, that of ashpit cleansing. As the old system disappeared, ashpit refuse became more valuable at the destructor for steam producing purposes. Power to provide public slaughter-houses was obtained in the year 1874, but it was not until 1890 that the abattoir was opened and private slaughter-houses closed. It was a fact worthy of mention that the whole of the private slaughtering places in the district were closed without the authority having to pay a single penny compensation. On capital account the outlay on the abattoir had been 4,500*l*., and the maintenance and sinking fund charges amount to about 100*l*. per annum more than the income, but the Council considered it money well spent, and this view was endorsed by the general body of ratepayers. The necessity of providing an isolation hospital was forced upon the town by the closing of the Bradford Fever Hospital to the outside districts, and in 1890 the Council acquired two acres of ground at Stony Ridge, an elevated and healthy part of the district near to the western boundary. Exclusive of a grant of 736*l*. from the authorities of the Bradford Fever Hospital, the Council had expended 3,921*l*. The buildings comprise administrative block, four wards, washhouses, disinfecting chambers, mortuary, laundry, and smallpox hospital of two wards. The Council had obtained power for an extensive provision of tramways for the district. The first purchase of tramways by the Shipley Council took place in 1894, when they acquired the lines which had previously been used for horse trams by a company which failed to make them pay. This line, known as the Bradford and Keighley Road Tramway, was afterwards leased to a tramway company at a rental, but in the present year the Council arranged for the conversion of the line for electric traction. In May the conversion was completed to double line for a distance of about 1½ miles. In the meantime the Council had installed their electricity works, and they were able to add to their supply of current for lighting and power that of tramway traction. The tramway works in the Bradford and Keighley-roads had been carried out on the plans of Mr. R. C. Quin, M.I.E.E., Consulting Engineer, who had directed the contracts except those for the permanent way, which had been superintended by Mr. Dawson, the Council's Surveyor. The sewage and sewage-disposal works had been carried out under two engineers—Mr. M. Paterson, C.E., for the Shipley portion of the district and outfall works, and Messrs. W. B. Woodhead & Son, civil engineers, for the sewage of the Windhill district. Plans were adopted in 1894, and early in 1897 the sanction of the Local Government Board was obtained to an expenditure of 56,000*l*. Since that time the Council had been continually spending money on sewage and out-

* We decline altogether to regard 30 gallons per day as "extravagant."—ED.

It may now be of interest to briefly describe a few modern English institutions. I have had the pleasure of visiting the sanatorium near Crookesbury Ridges, under the direction of Dr. J. Rufenacht Walters. The sanatorium consists of two one-storied pavilions, one of eight and one of twelve single bedrooms, facing south, all with French casement windows opening on to a verandah, canvas covered, for reclining couches; corridors run the whole length behind the rooms. There are two nurses living in the buildings and one masseuse. The cubic capacity of the rooms per patient is about 1,100 ft. The floors are of wood covered with linoleum. The walls and ceilings are of plaster with slightly concave angles. The ventilation is by the windows, by inlet tubes, and by shafts at ceiling level across the corridor to the north. In the newer eight-bed block there are fanlights to the doors, so that all the room may be scoured with air. There are four bathrooms, two having needle-baths. The dining-room is attached to the older pavilion opening from the corridor, and beyond it are the kitchen and offices. The heating is by hot-water radiators. The lighting is by electricity.

A larger institution is that called Pinewood, at Wokingham. This has accommodation for sixty-four patients, each in a single bedroom of an average cubic capacity of 1,100 ft. The institution consists of a central block of three stories, containing the consulting-rooms, offices, and dispensary, with residences for the medical staff above. Detached from this on either hand is a patients' block of two stories, each block containing thirty-two single bedrooms. These blocks face south-south-east and south-south-west, and each has a corridor on the inner or northern side. There is one staircase in each. The ground-floor walls are of brick; the first floor is enclosed by wood framing covered with boards and tiles. There is one resident nurse in each block. The douche and slipper-bath rooms and water-closets are on the north side of the corridor, and open directly from it. The windows are single casements, which do not reach the ceiling. The doors have no fanlights. There are no verandahs or balconies. The floors are boarded and covered with linoleum. Walls and ceilings are of plaster. There are concave angles, except to floors, where angle fillets are fixed. The heating of rooms is by open fires, that of corridors by hot water radiators. Lighting is by electricity. The administrative block is detached to the north; it contains a handsome dining-room, with service and nurses' rooms attached, kitchen and offices (with female staff bedrooms over), and other rooms adjacent. There is a laundry block with disinfector, an engine-house, stables, &c.

I may now perhaps describe a sanatorium which the Brompton Consumptive Hospital is erecting at Frimley, in Surrey, from my designs. It is to accommodate 100 patients, and, unlike the others, it is for non-paying inmates. The site is high, and well wooded with fir trees. There are forty-eight single bedrooms, eight with two beds and twelve with three beds. Every patient's room will face S., S.S.E., or S.S.W. Outside the central block is a wide paved terrace. It will be noted that we have provided a large number of single bedrooms, and in other rooms have fixed our maximum at three beds. Many of the German doctors with whom I have discussed the question favour this as the maximum. The sanatorium proper, or patients' block, consists of a central building three stories high, with four radial wings or pavilions two stories high, all built of brick, the upper story tile hung on the brick, the roof being also tile covered. All wings are practically detached, and in a pine country this tends to limit the risks of fire and consequent danger to patients. By this arrangement of plan any one floor of the two or four wings may be appropriated to women, leaving the others for men; each group is self-contained, with its separate sanitary conveniences. This plan also affords much greater facilities for classification than could be found in one building of the ordinary type. The main entrance hall is in the centre, and behind it is a dayroom facing south, with two three-bed wards at the sides. East and west of the hall are the consulting and matron's rooms, dispensary, and sister's duty-room. The first floor has similar patients' and sisters' accommodation, a committee-room, a residence for the matron, rooms for the sisters, and a maid's room. Overhead, in the roof, are bed-rooms, &c., for female servants, with their bathrooms, &c. The pavilions are connected to the centre by enclosed corridors having windows on both sides. Each wing contains twenty-two beds. The corridor on the north side has no obstruction whatever to light and air. Opposite every room door there is a window in the corridor, and as all doors have fanlights carried, like the windows, to the ceiling, we shall get through ventilation, and even on hot sultry days the cooler air on the north side of the building will induce a current to the hotter south side. The windows are casements, those on the ground floor opening to the floor so that, if necessary, beds may be wheeled ont. The casements on the ground floor are so constructed as to keep out rats and other vermin, while the windows may remain wide open. On the first floor there will be outside jalousie shutters, which can be closed either to exclude rain or intense sun heat, the windows remaining open. On the ground floor rolling canvas blinds, like those over shops, will effect not only the same purpose, but will shelter beds or couches outside. By this means we get the advantages of a verandah without any of its drawbacks. On each floor are large linen-rooms, and on the ground floor are boot-rooms. Between each pair of pavilions is a sanitary tower, detached except for a cross-ventilated lobby. This contains all the patients' water-closets, baths, lavatories, and housemaids' closets. For the nursing staff on duty separate ward kitchens, lavatories, and water-closets are provided on both floors. There are separate entrances to each pair of pavilions, two main staircases, and at the outer end of each pavilion a fire-escape staircase. The heating generally will be by hot water, the lighting by electricity. The floors will be of wood covered with linoleum, and all walls and ceilings will be of plaster with concave angles everywhere. To the north of the sanatorium proper are the two patients' dining-rooms and a general assembly hall. Behind are the kitchen block, female servants' hall, men's room, &c. At the east end is the nurses' home, at the west the medical officers' and men servants' residence. Nearer the main road are the laundry, boiler, and electrical engine houses, electrical ambulance house, mortuary and gate lodge. There are two laboratories.

Lastly, may I be permitted to refer to the new Camberwell Infirmary in course of erection from my designs. There will be 800 beds in the institution. My reason for mentioning it here is, that the Board of Guardians have, on the advice of the medical superintendent, Dr. Keats, and myself, made special provision for tuberculosis patients. We have three large wards of twenty-four beds each, in which practically the whole length of the walls on three sides are made to open, so that the patients may be said to lie in the open air, and above the wards are flat roofs with easy access, so that some patients can be actually in the open air all day long.

THE PROVISION AND CONSTRUCTION OF SANATORIA FOR PULMONARY TUBERCULOSIS.*

AN ideal sanatorium cannot be designed on a cramped site, and not only should the site be ample enough to allow the buildings to be arranged to the best possible advantage, but there should also be grass land around to ensure the absence of dust, and to afford room for walks and exercise. A sanatorium for consumption must be considered as a specially designed hospital in which an infectious disease is to be treated.

"In order to facilitate the maintenance of healthy conditions in a hospital the form of the building should be such as to ensure the provision and proper application of (1) fresh air, with the necessary warmth and coolness; (2) ample light, including the penetration of sunlight to every part; (3) purification of floors and walls."

These words of Sir Douglas Galton will apply with even greater force to sanatoria, and in an ideal building the following requirements are essential:—(*a*) Free play of sunlight upon each room and block of buildings provided for the patients' accommodation. (*b*) The freest possible circulation of air around each building, and the avoidance of all enclosed spaces in which air would be liable to become stagnant. (*c*) Ample space between the various buildings. (*d*) Facilities for enabling the patients to spend the greater part of each day in the open air. (*e*) Sufficient compactness of plan to allow of all departments being placed within reasonable distance of the administrative centre, which should be separated from the patients' quarters. (*f*) Isolation of the engine and boiler-house, the laundry, mortuary, and other subsidiary buildings. (*g*) Departmental separation of male and female patients, whose quarters and exercise grounds should be placed on either side of a central administrative block.

The best type of sanatorium for small numbers probably is one built on the village system, in which the patients live in detached chalets, which are grouped around a central administrative block. Not only is free circulation of air and light promoted, but there is no institution look about the place. The patients feel more at home, and scarcely realise that they are in a hospital. But such a plan is not the best for a sanatorium containing 100 or more patients, as the labour of supervision and administration in a public institution consisting of a multitude of detached units, together with the expense of maintenance, would be prohibitive. A compromise may be effected by planning a series of pavilions, each consisting of a one-storied row of single rooms, completely surrounded by a verandah, with their long axes radiating from the central administrative block with which they are connected by a wide open corridor. Such a sanatorium has all the advantages of free circulation of air and light which the sanatorium of the "village" type possesses, while it is as easily administered and supervised as a large hotel.

The drawings which we exhibit to-day constitute an attempt to design a sanatorium of this type, to give accommodation to eighty-eight patients of the usual hospital class, and to twelve paying patients who require better accommodation. Provision has been made for an administrative block, arranged with the object of interfering as little as possible with the free circulation of air and sunshine. The front is two stories in height, and has a southern aspect. Behind this building is a long range of one-storied buildings, the principal rooms of which are lighted by lantern lights in addition to the usual side windows. The boiler house, laundry, &c., forming the centre of the semi-circular plan, are placed at the extreme north end of the central block. Then pavilions containing sleeping rooms radiate on either side, and an open corridor connects them with one another and with the administrative building. Twelve separate chalets for the accommodation of better class patients are placed between the pavilions and the front administrative building. The stereotyped design seen in so many asylums and hospitals has been carefully avoided. A good æsthetic result may be obtained without the employment of costly stone quoins, cornices, and so-called enrichments. The bungalow type of building appears to be the best for our purpose, and the elevations conform to the plan. Without going into detail we may say that in a sanatorium all the usual precautions against dirt and dust, such as rounded corners, hard impermeable walls, terrazzo or teak flooring would be required.

In the front administrative block on the ground floor spacious dining, drawing, reading, and recreation rooms for the use of the better class patients open into a large central hall. On the first floor are bedrooms for the matron and nurses, and on the attic floor, approached by separate staircases, sleeping accommodation is provided for the servants of either sex. The kitchen occupies a central position between the dining-rooms allotted (*a*) to the patients, (*b*) to the nurses, and to the servants. An extraction fan placed in a large lantern light ensures thorough ventilation, and in order to obviate the possibility of any cooking fumes permeating into the adjacent passages, it is approached through well-ventilated lobbies, placed at either end, and forming the necessary serving rooms in connexion with the kitchen. On either side are the necessary provision and store rooms, and surrounding the building in front is a wide covered verandah, which is prolonged on either side into a raised terrace. On the west side an annexe is provided for medical work. This comprises patients' waiting and dressing rooms, consulting room, and an inner room for physical diagnosis. On the opposite side of a central passage are the laboratories, together

* Part of a paper by Mr. A. W. S. Cross, B.A. Cantab., F.R.I.B.A., and Mr. A. G. Walsford, M.D., read before the Sanitary Institute Congress at Manchester.

with a dark room and an animal room. Overlooking the terrace are rooms for an assistant medical officer, and the dispensary and general office. On the east side a corresponding annexe contains the nurses' dining and day rooms. Dining-rooms for the patients and servants, recreation-rooms, including a library, a large winter garden and a chapel are provided in the main central block. The main corridor is centrally placed, and connects the pavilions with one another. This corridor, open at the sides, is on the same level as that of the floors of the pavilions, and beneath it is a subway for pipes, &c. On either side of the administrative buildings three separate pavilions, each containing fifteen rooms, are placed with their long axes radiating from the centre of the plan, and planned as separate and independent blocks, communicating by an open covered way, with the main corridor. Each room is provided with an open fireplace. Each pavilion is surrounded by a wide verandah, and the rooms open on to it by French windows or doors, which, to prevent direct draught, may be double, as efficient ventilation is assured by windows consisting of fixed glass louvres above the verandah roof. As these cannot be closed constant and efficient ventilation is provided without the use of pipes and tubes which collect dust, and are often worse than useless. Outside the windows, jalousie framed shutters are provided for use in very boisterous weather. The verandah is enclosed with glass at one end, to form a sunroom, but with this exception it is entirely open, and, unless the weather were very inclement, the windows of the sunroom would be always open. The verandah roof is glazed with thick unpolished plate glass, through which the sun's rays will not penetrate with full force. Each room has a floor area of 15 ft. by 12 ft., and a clear height of 14 ft. This gives a cubic capacity for each patient of more than 2,500 ft. Each pavilion practically consists of a row of one-roomed chalets, the verandahs of which communicate. This gives the opportunity to patients to obtain the full benefit of the open-air treatment as regards sunshine and fresh air. The better class patients are housed in separate chalets. Between the pavilions and the main building is a building containing a douche room, and a room in which special inhalations can be given. A glass room for the sun-bath treatment is provided. Fronting the main back road is a detached building containing the boiler-house, pumproom, the laundry, and the disinfector and destructor. Surrounding the boiler-house and laundry block is a wide road for vehicular traffic, in connexion with which is a branch inclined roadway, leading to a subway connecting the back with the front of the administrative buildings. The subway runs from north to south, and is of sufficient width to allow of a trolley service for the carriage of coals and provisions which would be brought in at the back entrance and conveyed to the kitchen. The open corridors afford ready access to all parts of the sanatorium without interfering with the circulation of air. The principal medical officer's house is within easy reach of the sanatorium, but separate from it. The grounds would be laid out with covered and open, level and inclined, paths, and with the usual desiderata of a well-appointed sanatorium, into the details of which we cannot enter now.

ASSOCIATION OF MUNICIPAL AND COUNTY ENGINEERS.

A YORKSHIRE district meeting of the members of the Incorporated Association of Municipal and County Engineers was held at the Council Offices at Shipley, on Saturday, September 13.

The President (Mr. T. H. Yabbicom, C.E., of Bristol) occupied the chair, and among those present were Messrs. A. D. Greatorex, West Bromwich; T. Cole, London (Secretary); W. H. Hopkinson, Keighley; C. F. Wike, Sheffield; J. H. Williams, Burnley; T. Kidd, Swadlincote; S. Edmondson, Burnley; S. Turner, Knaresborough; T. Scott, Tadcaster; A. S. West, Harrogate; E. J. Silcock, Leeds; C. Lund, Cleckheaton; E. R. S. Escott, Halifax; G. Fitton, Basingstoke; J. R. Wakeford, Bilston; and others.

Councillor Shaw, Chairman of the Council, received and welcomed the members and expressed his pleasure at receiving the Association.

The President acknowledged the welcome accorded to the Association. He believed their meetings were of mutual advantage to surveyors and to the authorities they represented.

Mr. W. H. Hopkinson, Borough Engineer, Keighley, was unanimously re-elected Honorary Secretary for the Yorkshire district.

Mr. I. Lindow, Clerk of the Council, presented a paper on the municipal works at Shipley. He prefaced the paper with an explanation that it was a journalistic effort, a collection of facts rather than an expert review of the works of the district. The town had been practically remodelled, but the heavy expenditure which had been incurred on street improvement work had abundantly justified itself, in that it had without doubt materially contributed to the progress of the district. It might fairly be claimed that the town was now generally provided with good wide sanitary streets, and that "slum" property, in the sense generally understood by that expression, was practically non-existent. Public needs and requirements had been provided for by an efficient scheme of water-works, a thorough system of drainage with outfall and purification works, public cemetery of twenty acres, isolation hospital, parks, modern public abattoirs, fire brigade, whilst the District Council had recently added, as part of the municipal works, the acquirements of the gasworks, the municipalisation of the Salt schools, and the institution of an electrical supply station for traction, lighting, and motor-power purposes. These works had been and were being carried out under three Acts of Parliament and seventy-five Provisional Orders, and sanctions for loans amounting in the aggregate to 751,281*l*. The growth of the district was shown by the following figures:—The population, which in 1881 was 15,080, was now over 29,000, whilst the rateable value in the same period had advanced from 68,000*l*. to over 108,000*l*. In the year 1853 Shipley was constituted a Local Government district under the Public Health Act, 1848, and in the following year the authority obtained the Shipley Waterworks Act, empowering them to construct waterworks, and thus giving them the right to supply what had now become a very large consumption of water. Further powers were obtained in an Act of 1874, and the storage reservoirs were increased to the extent of 95,000,000 gallons, so that at present, with a storage capacity of nearly 140,000,000 gallons, Shipley was provided with a storage equal (apart from compensation water) to 120 days' supply. The gathering grounds, which comprise an area of over 2,000 acres, formed part of the far-famed Rombalds Moor common lands. Shipley people were extravagant users of water, the consumption per head of the population being over 30 gallons per day;* and whereas the receipts from water used for domestic purposes had increased over 20 per cent. during the past seven years, the income for trade consumption had actually gone down. In an industrial centre such as Shipley this was no doubt exceptional; but it was due to the circumstance that manufacturers had availed themselves of the facilities for obtaining water from the canal and the river, and also by means of wells, the valley in which Shipley was situated providing a good supply of water for dyeing and other trade purposes. The want of elasticity in the income from water prevented the rates being benefited from that source, but the Council were enabled to encourage the use of water for sanitary purposes. In another sense the Shipley consumers had a right to congratulate themselves, because, whereas in most towns there was an extra charge made for baths and water-closets, householders in Shipley were entitled to one bath and one water-closet free, no extra charge being made for these on the ordinary scale charge for domestic purposes. It might be argued with some show of reason that free baths and water-closets were unfair to those consumers who had no such privileges, and who had therefore to accept the burden of providing for their more fortunate neighbours. An important consideration, however, was the encouragement which it gave builders to make healthy sanitary provisions, and new houses without baths and water-closets were now the exception. The expenditure on waterworks account had been 125,000*l*. Shipley was provided with a thorough system of drainage, both in regard to street drains and main outfall sewers, though the complete interception had not yet been carried out. The early adoption of an expensive street improvement scheme got rid of a considerable area of old property, paved the way for the provision of wide streets, both at the back and front of dwelling-houses, and led to the adoption of stringent by-laws, striking testimony to the benefit of which was afforded by the wide, healthy thoroughfares to be found in the district. During the past ten years there had been over 1,000 houses erected in the district, of which not more than a score had been provided with the common privies. Whilst insisting on thorough drainage to the houses, the Council had also had before them the necessity of the gradual removal of the common privies, and the substitution therefor of waste-water closets or the ordinary water-closets flushed from the town's mains. Within the last five years about 1,000 common privies had been converted into water-closets, the most notable instance of this conversion in the district being the "model village" of Saltaire, which was built over forty years ago on what was then considered an admirable principle. But the streets were narrow, and the old privies a constant nuisance and danger to health. To the credit of the Saltaire firm (Sir Titus Salt, Bart., Sons, & Co., Ltd.), they resolved to carry out a privy conversion scheme for the whole of their 800 houses. This scheme entailed a very heavy cost, but the benefit was to be seen in the improved health of the community, and sweeter surroundings of the dwellings. The example set by this firm was being followed pretty generally, and the authority had not met with much disinclination on the part of owners to get rid of the old insanitary conditions. This improvement had also enabled the Council to deal more effectively with another department, that of ashpit cleansing. As the old system disappeared, ashpit refuse became more valuable at the destructor for steam producing purposes. Power to provide public slaughter-houses was obtained in the year 1874, but it was not until 1890 that the abattoir was opened and private slaughter-houses closed. It was a fact worthy of mention that the whole of the private slaughtering places in the district were closed without the authority having to pay a single penny compensation. On capital account the outlay on the abattoir had been 4,500*l*., and the maintenance and sinking fund charges amount to about 100*l*. per annum more than the income, but the Council considered it money well spent, and this view was endorsed by the general body of ratepayers. The necessity of providing an isolation hospital was forced upon the town by the closing of the Bradford Fever Hospital to the outside districts, and in 1890 the Council acquired two acres of ground at Stony Ridge, an elevated and healthy part of the district near to the western boundary. Exclusive of a grant of 736*l*. from the authorities of the Bradford Fever Hospital, the Council had expended 3,921*l*. The buildings comprise administrative block, four wards, washhouses, disinfecting chambers, mortuary, laundry, and smallpox hospital of two wards. The Council had obtained power for an extensive provision of tramways for the district. The first purchase of tramways by the Shipley Council took place in 1894, when they acquired the lines which had previously been used for horse trams by a company which failed to make them pay. This line, known as the Bradford and Keighley Road Tramway, was afterwards leased to a tramway company at a rental, but in the present year the Council arranged for the conversion of the line for electric traction. In May the conversion was completed to double line for a distance of about 1½ miles. In the meantime the Council had installed their electricity works, and they were able to add to their supply of current for lighting and power that of tramway traction. The tramway works in the Bradford and Keighley-roads had been carried out on the plans of Mr. R. C. Quin, M.I.E.E., Consulting Engineer, who had directed the contracts except those for the permanent way, which had been superintended by Mr. Dawson, the Council's Surveyor. The sewage and sewage-disposal works had been carried out under two engineers—Mr. M. Paterson, C.E., for the Shipley portion of the district and outfall works, and Messrs. W. B. Woodhead & Son, civil engineers, for the sewage of the Windhill district. Plans were adopted in 1894, and early in 1897 the sanction of the Local Government Board was obtained to an expenditure of 50,000*l*. Since that time the Council had been continually spending money on sewage and out-

* We decline altogether to regard 30 gallons per day as "extravagant."—ED.

fall works, with the result that the original estimate had been exceeded by 30,000*l.*, and a further sanction beyond that was expected to be necessary. The whole system formed an epitome of the difficulties and dangers of constructing sewers through an intricate network of buildings, which, in course of time, had been allowed to cover the only natural line of drainage alongside the river and stream of a busy manufacturing district. Nine-tenths of the sewage conveyed by the main outfall sewer discharged into a sewage tank sewer holding 275,000 gallons, whence it was lifted 47 ft. by electrically worked pumps into triplicate settling tanks with a capacity of 50,000 gallons, being joined at the well-head by the sewage, which flowed by gravitation from the Windhill District. From these tanks it flowed into eight bacterial beds arranged in two tiers or rows of four coarse and four fine beds on the double-contact system. The coarse tanks had a bottom fall of 6 in., and were filled to a mean depth of 3½ ft. with coarse clinkers or engine ashes of 3 in. or 4 in. diameter. The fine tanks were filled to a like depth with the same material crushed and sifted to about 1 in. down to ½ in. gauge. Thus taking the net working capacity in sewage volume as one-third of the empty filter, the capacity of each fine filter was 48,750 gallons, or a total of 195,000 gallons, and being filled three times per twenty-four hours, he total volume which could be dealt with daily was 585 000 gallons. The effluent drain discharged into the river Aire, which at this point was, at present a black, fœtid sewer, owing chiefly to the discharge of sewage and trade refuse from neighbouring districts. The works described did not entirely meet the requirements of the Local Government Board, who were insisting upon the provisions of more bacteria beds, so that it would be possible to treat three times the dry-weather flow of the sewage of the district. When plans were originally prepared for the sewage outfall works, the question of providing destructors came under the consideration of the Council, and it was ultimately decided that these should be erected on the same site as the outfall works. After plans for the destructors and engine-house had been submitted to the Local Government Board, the Council considered it would be an advantage to have electricity works also on this site, in order that the steam raised by the burning of the refuse (over and above that required for sewage pumping) might be used in this direction. The result was that Shipley holds the almost unique position of having sewage outfall works, refuse destructors, and electricity works upon the same site. The destructor was of the Meldrum regenerative type, consisting of furnace, combustion-chamber, Lancashire boiler, and regenerator. The refuse burnt at Shipley—which, for steam-raising, was equal to about one-tenth best steam-coal—averaged about 600 tons a month, but, were the refuse obtainable, it would be quite possible to consume 300 tons weekly in this four-cell destructor. The object of the Council was so to combine the three works—destructor, sewage pumping, and electric lighting—that there could not only be utilisation of the steam produced by the burning of the ashpit refuse, but that there should be economy in management. The policy of combining an electric lighting and tramway-supply station with a destructor and sewage disposal works was quite unique, and had much in its favour. The same staff and the same management suffice for all the undertakings. An electrical engineer would always prefer to raise his steam from coal rather than from a refuse destructor, but it would be folly for a town the size of Shipley to allow steam-power raised by the destruction of refuse to be wasted. On the whole the success obtained at Dockfield had been very gratifying, and even better results were hoped for when the different units could be run on full load instead of being run a quarter load, or even less than that, and at times had been actually run non-condensing, in order to utilise the steam and get rid of the refuse.

On the motion of the President, seconded by Mr. Escott, Halifax, a vote of thanks was passed to Mr. Lindow.

Mr. A. D. Greatorex, West Bromwich, congratulated the Shipley Council upon possessing so many important works, considering the size of the town. He also congratulated them upon having got rid of most of the privies.

Mr. E. J. Silcock, Leeds, said that a consumption of 30 gallons of water per head per day in a town where manufacturers took their supply from other sources than the public supply seemed to be high. It was probably accounted for by the fact that the Council allowed a bath and one closet free of charge. He agreed with that policy, because the greater the facilities given to people to keep themselves and their houses clean the better their health was likely to be. In Leeds they were providing every cottage above a rental of 4s. 6d. with a bath, and he thought that provision would be extended to houses of a smaller class before very long. Turning to the question of sewage disposal, he said the materials used in the bacteria beds were obviously what they would expect, as they had a destructor there to produce clinker, but he agreed that a better material would be found the cheapest in the long run, because the breaking down of clinker was so great that the capacity of the beds was reduced to practically 50 per cent.

Mr. C. F. Wike, Sheffield, mentioned that he had been making experiments at Sheffield with bacteria beds for four years. He had put down two and a half acres of beds divided into two kinds—coarse and fine—and the results obtained were chemically perfect, amounting to 95 per cent. of purification. With respect to the engineering and financial part he would rather not go into figures at present, but he hoped some time to bring them before the Association. He first put down the beds with coke, but he had lately put down a set of tanks with destructor refuse.

Mr. Lynam, Burton-on-Trent, asked as to the character of the effluent from each part of the process, the coarse bed, the fine bed, and the land.

Mr. Lund, Cleckheaton, asked the amount of water evaporated by the destructor per pound of refuse.

Mr. Pitt, Chairman of the Sanitary Committee, drew attention to the fact that four-fifths of the sewage had to be pumped, while other towns in the Aire Valley got theirs to the outfall works by gravitation.

The President said that was entirely a matter of levels, upon which the engineer had advised the Council. It would be far better for the Council to accept that advice.

Mr. Lindow said that the cost of the tramway had not been above the average. That was as far as he ought to go, as they had an arbitration at the end of the month. The cost of the disposal of the town refuse was rather high, the collecting and disposing amounting to 3s. per ton. The sewerage and sewage disposal works were going to be very expensive to them, and they had not done yet. They had spent 10,000*l.* in easement and law expenses.

Mr. Paterson explained that they had decided to keep out trade effluents, as they were advised they would be a serious obstacle to the success of the bacterial system.

Mr. Schofield said the cost of the current for the sewage pumps worked out at ·36 of a penny per thousand gallons. In reply to Mr. Lund he said this was taking the electricity at one penny per unit.

The members were entertained at luncheon at the Saltaire Institute, where the discussion was taken, and visits were made to the electricity, destructor, and sewage disposal works, and to the Saltaire Mills of Sir Titus Salt & Co.

APPLICATIONS UNDER THE 1894 BUILDING ACT.

AT the meeting of the Building Act Committee of the London County Council held on the 3rd inst., the proceedings were governed by the clause in the order of reference which empowers the Committee at certain seasons to act on behalf of the Council in relation to matters included in the Committee's order of reference. The names of applicants are given in parentheses :—

Lines of Frontage and Projections.

Marylebone, West.—The retention of an iron sign in front of No. 520, Oxford-street, St. Marylebone (Mr. R. J. Browne for Messrs. Poile & Smith).—Consent.

Fulham.—Buildings on the east side of North End-road, Fulham, to abut upon Sedlescombe-road (Messrs. Boyton, Pegram, & Buckmaster).—Consent.

Chelsea.—A projecting porch, bay windows, turret, and balconies to a block of residential flats on the north-western side of Royal Hospital-road, Chelsea, at the corner of Franklin's-row (Mr. P. Hoffmann for Mr. F. Britton).—Consent.

Deptford.—Two houses, with one-story shops in front, on the east side of Horstead-road, Brockley (Mr. A. H. Kersey for Mr. R. Soper).—Consent.

Hammersmith.—An iron and glass shelter at the side of the new King's Theatre, Hammersmith-road, Hammersmith, to overhang the footway of Rowan-road (Mr. W. G. R. Sprague for Mr. J. B. Mulholland).—Consent.

Hampstead.—An iron and glass hood over the entrance doorway of No. 15, Aberdare-gardens, Hampstead (Mr. J. D. Hunter for Mr. B. Samuel).—Consent.

Islington, North.—That, at the request of Mr. A. R. Hind, the Council do permit the retention of a showcase on the forecourt of No. 449, Holloway-road, Holloway.—Agreed.

Islington, North.—That, at the request of the International Tract Society, the Council do permit the retention of a showcase on the forecourt of No. 451, Holloway-road, Holloway.—Agreed.

Lambeth, North.—A one-story addition in front of No. 35, Cornwall-road, Waterloo-road, Lambeth (Messrs. Corderoy, Selby, & Corderoy for the Lambeth Estate Co., Ltd.).—Consent.

Lewisham.—Bay-windows to four houses on the east side of Bromley-road, Catford (Messrs. Norfolk & Prior for Messrs. Kennard Brothers).—Consent.

Lewisham.—An addition to the basement story of No. 28, Brandram-road, Lee (Mr. F. Wenborn for Mr. R. B. A. Chambers).—Consent.

Lewisham.—Porches to Nos. 1A and 1B, Agnew-road, and Nos. 2A and 2B, Whatman-road, Forest Hill (Messrs. Pooley & Follett for Mr. F. Newman).—Consent.

Marylebone, East.—That the application of Mr. H. O. Cresswell on behalf of the trustees of the Eyre estate, for an extension of the periods within which the erection of buildings on the south-west side of Park-road, Regent's Park, was required to be commenced and completed, be granted.—Consent.

St. George, Hanover-square.—A portico at No. 13, Upper Brook-street, St. George, Hanover-square (Mr. P. A. Todd for Mr. W. Tebb).—Consent.

Strand.—That the request of Messrs. Wylson & Long on behalf of Mr. F. Anstiss, for permission to retain a projecting illuminated sign at the third-floor level, in front of No. 45, Strand, extending beyond the general line of buildings in that street, be acceded to.—Agreed.

Wandsworth.—Two projecting oriel windows at the Foresters' Arms beerhouse, Mitcham-lane, Tooting (Mr. H. Griffiths for Mrs. C. Beard).—Consent.

Woolwich.—A one-story shop on part of the forecourt of No. 47, Plumstead-road, Woolwich (Messrs. Church, Quick, & Wincop for Mr. B. H. De Bertodano).—Consent.

Woolwich.—A vicarage room on the south side of Upper Ripon-road, Plumstead (Mr. V. E. Young for the Rev. S. Warner).—Consent.

Hackney, South.—A warehouse building on the site of Nos. 9 and 11, London-lane, Mare-street (Mr. W. A. Lewis for Mr. N. Fortescue).—Consent.

Hampstead.—Erection of an iron and glass covered way in front of No. 143, Abbey-road, Kilburn (Mr. W. Daniell for Mr. W. Gunn).—Refused.

Brixton.—A building on the west side of Brixton-hill, Brixton, to abut upon Acre-lane (Mr. C. W. Stephens for Messrs. Isaac Walton & Co.).—Refused.

Hackney, North.—Four houses on the south side of Cazenove-road, Upper Clapton, to abut also upon Goldeston-road (Mr. C. Cheston for Lord Amherst).—Refused.

Hackney, Central.—Erection of a block of buildings on the site of Nos. 220 and 222, Mare-street, Hackney (Messrs. Holman & Goodrham for the Royal London Friendly Society).—Refused.

Hammersmith.—An iron, concrete, and glass shelter in front of the new King's Theatre, Hammersmith-road, Hammersmith (Mr. W. G. R. Sprague for Mr. J. B. Mulholland).—Refused.

Hampstead.—A modification of the conditions upon which consent was given to the erection of residential flats, with projecting one-story shops and bay windows, on the west side of Finchley-road and east side of Fortune Green-lane, Hampstead (Mr. G. H. Green for Mr. W. H. Pearce).—Refused.

Islington, West.—A one-story shop in front of No. 86, St. James-road, Holloway (Mr. A. Roods for Mr. J. H. Baldock).—Refused.

Kensington, North.—The erection of an addition to No. 24, Chepstow Villas, Notting Hill, at the corner of Ledbury-road (Mr. T. Baggallay for Mr. H. P. Hall).—Refused.

Norwood.—Erection of one-story shops in front of Nos. 16 to 26 (even number only) inclusive, Tulse Hill, Norwood (Messrs. Peacock Brothers for Mr. H. G. Englefield, Mr. W. Sayer, and Mr. Tewson).—Refused.

St. George, Hanover-square.—The erection of an addition in front of No. 9, Grafton-street, Piccadilly (Mr. W. A. Large for Messrs. Matkin & Lawson).—Refused.

Wandsworth.—Erection of one-story shops in front of eight houses on the north side of Replingham-road, Southfields (Mr. D. Mathews for Mr. G. A. Gale).—Refused.

Wandsworth.—One-story shops on the forecourts of eight houses on the north side of Rosendale-road, Herne Hill (Mr. P. C. Davies for the Suburban Building Land Co., Mrs. V. Davies, and Mr. R. Parry).—Refused.

Westminster.—A conservatory on a balcony at the first floor level in front of No. 57, Victoria-street, Westminster (Mr. L. Hervey for Mr. G. C. T. Bartley, M.P.).—Refused.

Woolwich.—The re-erection of Nos. 3 to 13 (odd numbers only) inclusive, New-road, Woolwich, with the main fronts to an advanced line in that street (Messrs. Church, Quick, & Whincop for Mr. B. H. D. Bertodano, Mr. C. H. Court, Mrs. E. Bridger, and Messrs. J. & C. E. Pearson).—Refused.

Woolwich.—A building, to be used as a Sunday school, on the north side of Glenure-road, Eltham (Mr. H. Busbridge for Mr. W. J. Smith and others) —Refused.

Deptford.—The rebuilding of the Crown and Anchor public-house, No. 43, New Cross-road, Deptford, at the corner of Avonley-road (Messrs. C. Saunders & Son, Ltd., for Messrs. Noakes & Co., Ltd.).—Refused.

Width of Way.

Fulham.—A stable building on the north side of Peterborough-mews, Fulham, with the external walls at less than the prescribed distance from the centre of the roadway of the street (Mr. H. Harris). —Consent.

Hoxton.—A warehouse building at the rear of No. 97, Curtain-road, Hoxton, with the external wall at less than the prescribed distance from the centre of the roadway of Welch's-buildings (Mr. R. Peters for Mr. W. C. Wigg).—Consent.

Newington, West.—A staircase addition to No. 16, Hurlbutt-place, Newington, with the external walls at less than the prescribed distance from the centre of the roadway of the street (Mr. J. G. Arpin).—Consent.

Brixton.—A two-story building on the west side of Cumberland-place, Brixton, with the external wall at less than the prescribed distance from the centre of the roadway of the street (Messrs. Weston & Sons for Mr. E. Jones).—Refused.

Islington, West.—A range of one-story cart-sheds on the south side of Pleasant-grove, York-road, Islington, with the external walls at less than the prescribed distance from the centre of the roadway of the street (Mr. C. W. Reeves for Messrs. Bennett, Son, & Co.).—Refused.

Limehouse.—Re-erection of the Waterman's Arms beer-house on the south side of Maroon-street, Limehouse, at the corner of Conder-street (Mr. W. Stewart for Messrs. Mann, Crossman, & Paulin, Ltd.).—Refused.

Rotherhithe.—The retention in front of Nos. 50A and 50B, Farncombe-street, Bermondsey, and a two-story workshop on the south side of that street, of a boundary fence at less than the prescribed distance from the centre of the roadway of the street (Messrs. Barnes-Williams, Ford, & Griffin for Mr. A. W. Crips).—Refused.

Wandsworth.—Seven houses on the east side of Aboyne-road, Earlsfield (Mr. R. A. Hinds, for Mr. G. Edwards).—Refused.

Space at Rear.

Strand.—Re-erection of the Wellington Hotel, No. 351, Strand, at the corner of Wellington-street, with a portion of the building extending over the space required by Section 41 of the Act to be provided at the rear of these premises (Messrs. Bird & Walters, for Messrs. G. and C. Snow).—Consent.

Chelsea.—A conservatory on the open space at the rear of Old Swan House, No. 17, Chelsea-embankment (Messrs. J. Weeks & Co., Ltd., for General E. H. Sartorius, V.C.).—Consent.

Deptford.—Two dwelling houses on the east side of Horstead-road, Deptford, with an irregular open space at the rear (Mr. A. H. Kersey for Mr. R. Soper).—Consent.

Lewisham.—No. 2, Stillness-road, Brockley-rise, Lewisham, with an irregular open space at the rear (Mr. G. M. Webb).—Consent.

Islington, East.—Re-building of the Hen and Chickens public house, and Nos. 128 and 130, Canonbury-road, Islington (Mr. W. A. Aickman for Mr. L. Taylor).—Consent.

Lines of Frontage and Width of Way.

Norwood.—The retention of buildings on the north side of George-street, Gipsy Hill, Norwood, the external walls of one of such buildings and the forecourt fence being at less than the prescribed distance from the centre of the roadway of George-street (Mr. F. W. Ledger).—Consent.

Kensington, South.—A building on the south side of Stratford-road, Kensington, with balconies and a forecourt fence at less than the prescribed distance from the centre of the roadway of Radley-mews (Mr. C. R. Guy Hall).—Consent.

Clapham.—Buildings on the south-west side of Park Hill and western side of Abbeville-road, with the forecourt fence at less than the prescribed distance from the centre of the roadway of Park-place (Mr. E. Messiter).—Refused.

Lewisham.—A three-story dwelling-house on the north side of Catford-road, Lewisham, with the external walls of such building at less than the prescribed distance from the centre of the roadway of Thomas'-lane, and with a one-story shop in front (Messrs. Eedle & Meyers for Mr. E. J. Beaumont). Refused.

Paddington, South.—Three projecting porches to a proposed hall on the east side of Newton-road, Paddington, with the external walls of such porches at less than the prescribed distance from the centre of the roadway of the street (Mr. T. P. Figgis for the Building Committee of St. Paul's Presbyterian Church, Westbourne-grove).—Refused.

Bermondsey.—The retention of a one-story building on the east side of Weston-street, Bermondsey (Mr. E. Crosse for J. Salomon & Co.).—Refused.

Width of Way, Line of Frontage, and Construction of Building.

Fulham.—The retention of a wood and iron structure on the forecourt of No. 282, North End-road, Fulham (Mr. W. D. Thompson for Messrs. T. Crowther & Son).—Refused.

Line of Frontage and Space at Rear.

Wandsworth.—A building, to be used as a beer-house, on portion of the site of Nos. 8 and 10, High-street, Tooting, to an advanced line of frontage in Selkirk-road (Mr. D. Watney for Messrs. Attlee).—Refused.

Line of Frontage and Construction.

Bethnal Green, North-East.—An iron balcony at the Children's Home Hospital, No. 22, Bonner-road, Bethnal Green (Messrs. Holman & Goodrham for the trustees of the Children's Home).—Refused.

Bermondsey.—Two temporary wooden shops on the south side of Prater-road, Dockley-road, Bermondsey, to adjoin Spa-road Station (Mr. A. Thompson for the South-Eastern Railway Co.).—Refused.

Width of Way and Construction of Building.

Kensington, South.—A temporary wood, iron, and brick motor-car shed in the garden at the rear of No. 4, Bolton-gardens, Old Brompton-road, Kensington, with the external walls of such building at less than the prescribed distance from the centre of the roadway of Bolton-gardens South (Mr. W. Cave for Mr. W. H. Lawrence Copeland, M.D.).—Refused.

Formation of Streets.

Paddington.—That, at the request of Mr. H. A. Hunt, the Council do permit the retention of wooden fences or barriers across the western end of Lauderdale-road, the north-western end of Biddulph-road, at both ends of Ashworth-road and at both ends of Delaware-road on the Paddington estate, Sutherland-avenue, Paddington.—Agreed.

Greenwich.—That an order be issued to Mr. L. Sandilands sanctioning the formation or laying-out of a new street for carriage traffic to lead from Toddmans-lane to Woodlands Park-road, Greenwich, and in connexion therewith the widening of a portion of Toddmans-lane and Woodland-place (Mr. D. G. Horlock).—Consent.

Hampstead.—Deviation from the plan sanctioned on March 24, 1902, for the formation of a new street to be named "Howitt-street," to lead from Haverstock Hill to Glenilla-street, so far as relates to an alteration in the position of the outlet of the new street into Haverstock Hill (Mr. C. J. Bentley for Mr. J. C. Hill and himself).—Consent.

Holborn.—A deviation from the plan sanctioned on February 6, 1900, for the formation or laying-out of two new streets to lead out of the east side of Tottenham Court-road into Chenies-street and Store-street respectively, so far as relates to the abandonment of the proposed street to lead from Tottenham Court-road to Store-street (Mr. A. Murray for the City Lands Committee of the Corporation of London).—Consent.

Woolwich.—That an order be issued to Messrs. Tapp & Jones sanctioning the formation or laying out of new streets for carriage traffic proposed to be named Brixham-street, Grenadier-street, Baronet-street, and Dock-street (in continuation), on the north side of Elizabeth-street, Woolwich).—Consent.

Fulham.—The retention of a wooden fence across Vera-road, Fulham, at about its centre (Mr. H. G. Brace for Mr. W. Moss and Mr. E. Messiter). —Consent.

Greenwich.—That an order be issued to Mr. J. Ellis refusing to sanction the formation or laying out of a street for carriage traffic, proposed to be named Attilla-street, at the rear of houses on the south side of Cedar-grove, Charlton.—Agreed.

Wandsworth.—That an order be issued to Mr. W. H. Marler refusing to sanction the formation or laying out of new streets for carriage traffic on the Furzedown Park estate, Mitcham-lane, Streatham. —Agreed.

Hampstead.—That an order be issued to Mr. E. Owers refusing to sanction the formation or laying out of new streets for carriage traffic on the Burgess Park estate, Finchley-road, Hampstead (for Major A. Burgess and Major W. H. Burgess.—Agreed.

Lewisham.—That an order be issued to Messrs. Norfolk & Prior refusing to sanction the formation or laying out of new streets for carriage traffic on the Mountfield Estate, George-lane, Catford (for Mr. C. C. Story).—Agreed.

Wandsworth.—That an order be issued to Mr. E. B. l'Anson, refusing to sanction the formation or laying out of a new street for carriage traffic to lead from Streatham High-road to Tooting Bec-road (for Mr. C. Mortimer).—Agreed.

Wandsworth.—That an order be issued to Messrs. H. E. Milner & Sons, refusing to sanction the formation or laying out of new streets for carriage traffic on the Furzedown Park Estate, on the south-east side of Rectory-lane, Tooting Common (for Sir Charles Seely).—Agreed.

Formation of Streets and Line of Frontage.

Norwood.—That an order be issued to Messrs. F. & W. Stocker, sanctioning the formation or laying out of three new streets for carriage traffic, to lead from Herne Hill to Elmwood-road, Dulwich, and in connexion therewith the widening of a portion of Herne Hill and the erection of buildings to an advanced line of frontage (for Mr. H. G. Smallman). —Consent.

Formation of Street, Lines of Frontage and Space at Rear.

Deptford.—That an order be issued to Messrs. Humphreys-Davies & Co. sanctioning the formation or laying out of a new street for carriage traffic out of the west side of Sanford-street, Trundley's-road, Deptford, and in connexion therewith the erection of houses (for the Surrey Commercial Docks Co.). —Consent.

Artisans' Dwellings.

Hammersmith.—A block of intended dwelling-houses, to be inhabited by persons of the working class, and proposed to be erected, not abutting upon a street, on a site at the rear of Nos. 209-219, King-street, Hammersmith (Mr. H. M. Newlyn for Messrs. Hinchliffe & Co.).—Consent.

Separation of Buildings.

Kensington, South.—The omission of party walls on the ground floor of a proposed building to form part of the premises of Harrod's Stores, Brompton-road, Kensington (Mr. C. W. Stephens for Harrod's Stores, Ltd.).—Refused.

Excess of Openings in External Walls.

Strand.—A building on the south side of Cursitor-street, Chancery-lane, Strand (Mr. R. C. Fry for Mr. H. Cox).—Refused.

Means of Escape from Top of High Buildings.

City.—Means of escape in case of fire, proposed to be provided on the sixth story of Cocker's Hotel, Nos. 18 to 21, Charterhouse-square, Aldersgate (Mr. E. Haslehurst for Messrs. Wheeler & Warren). —Consent.

Holborn.—Means of escape in case of fire, proposed to be provided on the sixth story of Cranston's New Waverley Hotel, Great Russell-street and Charlotte-street, Holborn (Mr. G. Waymouth for Mr. R. Cranston).—Consent.

Cubical Extent.

Finsbury, East.—The erection at No. 121, Bunhill-row, City, of a building to exceed in extent 250,000 but not 450,000 cubic feet, and to be used for the purposes of stores, saw mills, and joiners' shops (Messrs. Wakeford, May, & Woulfe for Messrs. W. H. Lascelles & Co.).—Refused.

Strand.—The erection at Windsor House, Breams-buildings, Holborn, of an addition which, together with the existing building, will exceed in extent 250,000 cubic feet, and be used only for the purposes of the trade of a printer (Mr. R. C. Fry for Mr. H. Cox).—Refused.

Wandsworth.—The erection at Garratt Works, Summers Town, Wandsworth, of a building to exceed in extent 250,000 but not 450,000 cubic feet, and to be used only for the purposes of the manufacture of metal-edged boxes, electrical conduits, &c. (Mr. A. A. Righter for the Corruganza Manufacturing Co.)—Refused.

Dwelling-houses on Low-lying Land.

Lambeth, North, and Southwark, West.—Dwelling-house and shop on low-lying land at No. 1, Gloucester-street, Lambeth (Mr. J. W. Jacomb Hood for the London and South-Western Railway Co.).—Consent.

LIVERPOOL BUILDING REGULATIONS.—A second edition, revised and enlarged, has been issued of "A Manual of the Building Regulations in force in the City of Liverpool," arranged and annotated by Mr. William Goldstraw, City Building Surveyor, with diagrams by Mr. James Dod, architect, surveyor to the Liverpool Exchange Co. The work is issued in two volumes, one containing the text and the other the diagrams. Mr. Goldstraw has furnished a code of all the building regulations in force in Liverpool, whether in local or general enactments, with one exception, viz., the Liverpool Fire Prevention Acts, 1843 and 1844. These Acts, applying solely to "warehouses," affect a much smaller section of the public, and have on that account been omitted. The diagrams prepared by Mr. Dod illustrate the text of the regulations with regard to the most usual cases occurring in practice. Messrs. Tinling & Co. are the publishers.

The Student's Column.

THE CHEMISTRY OF BUILDING MATERIALS.

12.—IRON AND STEEL.

PURE iron is not an article of commerce. Pig iron, cast iron, wrought iron, mild steel and hard steel, are all forms of iron admixed or combined with small proportions of other elements.

Irons, even of the same commercial class, vary considerably in composition, and there is no sharp line of demarcation distinguishing one class from another. An ingot of iron or steel is not even of uniform composition throughout its mass, for the unequal rate at which the metal cools and the differences in the solidifying points of the various impurities cause the elements to be unevenly distributed through the solidified mass.

Each foreign element present in the iron has its own peculiar effect upon the physical properties of the metal, but the nature of the influence of the foreign element when not combined with the iron is entirely different to that which it exerts when in chemical combination with the iron.

The following analyses may be regarded as representative of the composition of typical samples of the various classes of iron :—

TYPICAL ANALYSES OF IRON AND STEEL.

—	Grey Cast-iron	Hard Steel.	Mild Steel.	Wrought Iron.
Authority....	Bodeman.	Phillips.	Phillips.	Thorpe.
Iron	91·42	98·75	98·85	99·863
Combined Carbon	1·44	1·07	0·49	0·054
Graphitic Carbon	2·71	—		
Phosphorus ..	1·22	trace	0·03	trace
Sulphur	trace	trace	0·03	0·055
Silicon	3·21	0·06	0·01	0·028
Manganese ..	trace	0·19	0·57	—
Copper	—	—	0·02	—
	100·00	100·00	100·00	100·000

Carbon in Iron.—Carbon is always present in iron, partly in chemical combination, and partly in a free state as graphitic carbon. The total quantity of carbon in pig iron varies from about 1½ per cent. to 4½ per cent. The graphitic carbon does not appear to exert much influence upon the properties of the iron, but the combined carbon is of the first importance, as it is to this ingredient that the hardness of the metal is largely due. The following table shows the proportion of *combined* carbon present in the different classes of iron :—

	Combined Carbon.
Cast iron.....	0·1 to 4·0 per cent.
Hard steel ...	0·5 to 1·5 " "
Mild steel ...	0·15 to 0·5 " "
Wrought iron	nil to 0·15 " "

Silicon in Iron.—Silicon increases the hardness of the iron. Its effect upon the properties of the iron depends to a considerable extent upon the proportion of carbon and other foreign elements present. Generally speaking, the proportion of silicon should not exceed 2·5 per cent. in cast-iron, nor more than 0·4 per cent. in steel. Wrought-iron should be almost free from silicon.

Sulphur in Iron tends to render the metal brittle at high temperatures, and its proportion should not exceed 0·1 per cent. in any form of iron or steel. The presence of a small proportion of manganese reduces the prejudicial influence of the sulphur.

Phosphorus renders the iron more readily fusible, and more perfectly fluid when in a molten condition, but also increases the brittleness of the metal. Steel should be as free as possible from phosphorus, and wrought-iron should not contain more than 0·2 per cent. Cast-iron often contains over 1 per cent.

Copper may be present to the extent of 0·8 per cent. if the proportion of sulphur present be not excessive. Copper increases the tensile strength of the iron.

Iron Ores.—The principal ores from which iron is manufactured are :—

Magnetic Iron Ore (magnetic oxide), found in Sweden, Norway, Russia, and North America.

Red Hæmatite (anhydrous ferric oxide), found in Lancashire, Cumberland, and Glamorganshire.

Brown Hæmatite (hydrated ferric oxide), found in Cumberland, Durham, and in France.

Specular or *Micaceous Ore* (crystalline ferric oxide), found in Spain, Nova Scotia, and Elba.

Spathic Iron Ore (carbonate of iron), found in Somerset and Durham, and in Styria and Corinthia.

Clay Ironstone (carbonate of iron with clay), found in South Wales, Yorkshire, Staffordshire, Derbyshire, and in Silesia and Belgium.

Blackband Iron Ore (clay ironstone, with bituminous or coaly matter), found in Durham and Staffordshire, and in North Wales and Scotland.

Preparing the Ore for Smelting.—The ore is broken to small fragments and the pieces of gangue seen to be free from iron ore are removed. In the case of magnetic ores the ore is sometimes powdered, and, by means of revolving magnets, the magnetic ore is separated from the non-magnetic gangue. Hæmatites and carbonates when roasted at a high temperature also yield magnetic oxide, which can be separated from the gangue by the revolving magnets.

Unless the ore is already in the form of iron oxide, it is usually roasted before passing to the smelting furnace. The roasting causes the expulsion of water, sulphur, and carbon dioxide from ores containing those substances, and converts the iron compound into iron oxide.

Smelting.—The iron ore, in the form of impure iron oxide, is mixed with limestone or other flux, and alternate layers of coke or coal and of the iron ore mixture are placed in a cylindrical furnace 60 ft. to 100 ft. in height.

When the furnace is in operation a blast of hot air is forced up through the fuel and iron ore.

The action of the air upon the incandescent fuel is to produce gaseous carbon monoxide, which abstracts oxygen from the iron oxide and leaves metallic iron in a molten condition, thus :—

$$Fe_2O_3 + 3\,CO = Fe_2 + 3\,CO_2.$$

The lime from the limestone, the ash from the fuel, and the siliceous impurities from the ore are all liquefied and form the glass-like refuse from the furnace known as *slag*. This blast-furnace slag consists mainly of silicate of lime and alumina.

The gas which leaves the upper part of the furnace is combustible, for, although it contains all the incombustible nitrogen of the air admitted in the blast, and a certain proportion of carbon dioxide, it also contains sufficient carbon monoxide to enable it to be ignited and used for heating the air blown into the furnace, and for other purposes.

Pig Iron.—The molten iron is allowed to run out of the furnace into bar moulds capable of containing about 1 cwt. of the metal. Crude iron in this ingot form is known as pig iron.

Pig iron is divided in commerce into six grades, the classification depending upon the appearance of the freshly fractured surface of the metal. Nos. 1, 2, and 3 are called foundry pigs and are used for castings. Nos. 4, 5, and 6 are called forge pigs and are used for conversion into wrought iron. The foundry pigs are more fluid when molten than the forge pigs.

Cast iron is pig iron which has been remelted and re-cast. *Grey cast iron* is made from foundry pigs, and contains a large proportion of graphitic carbon. *Mottled cast iron* is made from No. 4 pig, and has a larger proportion of combined carbon but less graphitic carbon than grey iron. It is lighter in colour and stronger than grey iron. *White cast iron* exhibits no flakes of graphite, and shows a silver white surface when freshly fractured. It is not sufficiently fluid when melted to be suitable for castings.

Wrought iron, also known as *malleable iron* and as *weld iron*, is the purest of the commercial forms of iron. It cannot be used for castings because it is infusible at ordinary furnace temperatures. It contains less carbon than either cast iron or hard steel, but there is little difference between the chemical composition of some of the hardest forms of wrought iron and that of the mildest steel. The small proportion of carbon always present in wrought iron exists almost entirely in combination with the iron and not as graphitic carbon.

Manufacture of Wrought Iron. — Several methods are used for the production of wrought iron. The process most extensively employed is the "puddling" or "pig boiling" process. Pig iron is melted on the hearth of a reverberatory furnace in which the flame from the burning fuel, and a current of air, play upon metal. Hæmatite or some other oxidising material is added to the iron, and the molten metal becomes covered with a layer of liquid slag.

Gaseous carbon monoxide escapes from the molten metal, and rising through the liquid slag gives it a boiling appearance. The molten metal gradually changes from a mobile liquid to a thick plastic mass, and although the temperature of the furnace is now raised the iron remains sufficiently plastic to enable it, after being thoroughly puddled (stirred), to be rolled into "puddle-balls" weighing about ¾ cwt. each. These puddle-balls are lifted out of the furnace, hammered into slabs, and passed between rollers. The rolled metal is known as "puddled bar iron," and forms the lowest commercial grade of wrought iron. The higher grades are produced by re-heating and re-rolling the metal one or more times.

The effect of the hammering and rolling is to squeeze out most of the slag. Rolling also renders the metal more fibrous.

The impurities present in the original pig-iron are to a large extent oxidised and removed in the slag, but the carbon escapes in gaseous form as carbon monoxide. The following analyses may be regarded as representative of the composition of iron before and after puddling and rolling in the manner described :—

	Pig Iron.	Puddle Bar Iron
Iron	92·89	99·47
Carbon	2·89	0·20
Silicon	2·86	0·08
Phosphorus	0·70	0·12
Sulphur	0·16	0·08
Manganese	0·50	0·05
	100·00	100·00

Steel.—Steel containing from 0.15 to 0·5 per cent. of carbon is termed *mild* steel, and can be welded, but not tempered. Hard steel contains from 0·5 to 1·5 per cent. of carbon, and can be tempered. As the proportion of carbon increases welding becomes more and more difficult, but remains possible even when the proportion exceeds 1 per cent. The larger the proportion of carbon the harder and more brittle the iron.

Manufacture of Steel.—Many methods have been employed for the manufacture of steel, but the three most extensively adopted are (1) the cementation process, (2) the Bessemer process, and (3) the Siemens process.

The Cementation Process consists in embedding bars of wrought-iron in charcoal in a cementation furnace and exposing them to a bright red heat for from six to nine days. When the bars are withdrawn they are seen to have become blistered on their surfaces, the blisters being produced by gaseous carbon monoxide. The bars absorb some of the carbon in which they are embedded and become converted into steel, but they are not uniform in composition, and have, therefore, to be re-heated, hammered under a tilt hammer, and rolled. Steel so treated is known as "shear steel." If the hammering and rolling are repeated the metal becomes "double shear steel." If the blistered bars are melted in fire-clay vessels to render the metal more uniform in composition, the resultant steel is known as "crucible cast steel."

The Bessemer Process consists in blowing air through molten pig-iron in a "converter," and subsequently adding a small proportion (say, 5 per cent.) of an alloy of iron, manganese, and carbon, known as "speigeleisen." The air blown through the pig-iron removes most of the carbon and certain other impurities by converting them into gases.

The carbon added in the form of "speigeleisen" is sufficient for the conversion of the purified iron into steel.

The converter is in some cases lined with basic bricks, manufactured by heating raw bricks made of ground magnesian lime and pitch. The phosphorus present in the pig iron is, to a large extent, removed owing to its entering into combination with this basic material. When the furnace lining consists of ganister or other siliceous body, the phosphorus in the pig iron remains in the steel into which the iron is converted. Hence, pig iron selected for use in a siliceous or "acid" lined converter must not contain so much phosphorus as is permissible in pig iron to be converted into steel in a "basic" lined converter. In the basic process a considerable quantity of lime is used in the converter, and a slag containing much

phosphate of lime is obtained. This slag is largely used as a manure.

The Siemens Process consists in adding hæmatite ore (ferric oxide) to molten pig iron, either alone or mixed with scrap iron or steel, which has been heated to a molten condition upon the open hearth of a regenerative gas furnace. The hæmatite is added in small portions at a time, and the oxygen it contains oxidises the carbon and converts it into gaseous carbon monoxide.

When from the appearance of the metal it is thought that enough hæmatite has been added, a sample of the metal is withdrawn and tested. The iron having been sufficiently purified in this way, a charge of speigeleisen is added, as in the Bessemer process, and mixed with the molten metal until steel of the required composition has been produced.

GENERAL BUILDING NEWS.

TRINITY METHODIST NEW CONNEXION CHURCH, HILLSBRO', SHEFFIELD.—This new church is part of a scheme inaugurated by the Sheffield M.N.C. North Circuit. The new church is situated on Middlewood-road with a frontage to Hillsbro' Park. The design is that of the late Mr. John W. Firth, of Oldham, and the work has been carried out by his son. The side of the church and the frontage of the schools overlook Middlewood-road, while the main entrance to the church opens from Lennox-road. The schools are erected at the rear adjoining the main structure. Beyond the school, on the land joining up to Dorothy-road, sufficient space has been reserved to permit the erection of a minister's manse and a caretaker's dwelling; but these will be matters for future consideration. The contracts for the work were let as follows:—Excavating, drainage, brickwork, stonework, and concreting, Mr. Harris Wood, Shepley, near Huddersfield; carpentry and joiners' work, Mr. Geo. Broadbent, Shepley; plumbing, glazing, painting, and varnishing, Mr. George Lindley, Shepley; slating and plastering' Messrs. Geo. Beard & Sons, Thurlstone, Penistone; hot water engineering, Messrs. W. S. Spencer, Oldham.

NEW CHURCH, ST. ANDREWS.—The tenders for the building of St. Leonard's Church, St. Andrews, have been accepted, viz.:—For the mason work, Mr. William Ness; joiner work, Mr. Henry Law; plumber work, Mr. Andrew Turpie; and slater work, Messrs. Rintoul & Mackie—all of St. Andrews. The tile work is to be done by Messrs. Galbraith & Winton, of Glasgow. Several subsidiary contracts, including the heating, have not yet been fixed. The cost of the building, exclusive of the upper part of the tower, will be over 4,000*l*. The plans of the church, which is to be erected on a site in the Rathelpie district, have been prepared by Mr. Macgregor Chalmers, I.A., Glasgow, and they show a nave 75 ft. long, with an apsidal termination at the north end, in which the Communion table will be placed. On the west of the nave is a wide side aisle, also with an apsidal termination for the present baptismal font. The south front shows a gable terminating the nave, and a crow-stepped saddle tower about 60 ft. high at the end of the aisle. Both outside and inside the walls will be faced with ashlar in irregular courses, and the roofs will be covered with Buttermere green slates. The work is to be carried out locally under the superintendence of Mr. David Henry, architect, F.S.A.Scot., St. Andrews.

SUNDAY SCHOOL, NEW ENGLAND, PETERBOROUGH.—Extensions are being made to the New England Wesleyan Sunday school. A new schoolroom with classrooms is being built, and the work includes a slight improvement to the chapel. The present undertaking is estimated to entail an expenditure of 1,600*l*. Mr. J. Jameson Green, of Liverpool, is the architect.

QUEEN VICTORIA MEMORIAL AT LEITH.—At South Leith United Free Church, on the 6th inst., the ceremony of laying the memorial stone in the spire, and the foundation stone of the church hall, was performed. The spire has been given in memory of Queen Victoria, and when completed will be about 125 ft. in height. Messrs. Greig & Co. are the builders. Messrs. Hardy & Wight were the architects of the work.

EXTENSION OF THE YORK FEVER HOSPITAL.—The York City Council having applied to the Local Government Board for sanction to borrow the sum of 4,400*l*. for the extension of their fever hospital site, Huntington-road, an inquiry, directed by the Local Government Board, was held by Mr. R. W. Johnston, M.D., at York on the 8th inst. There were present the Town Clerk (Mr. R. P. Dale), the City Surveyor (Mr. A. Creer), and others.

HOSPITAL, OLD RATTRAY, PERTH.—A new joint-institution hospital is to be built for the burghs of Blairgowrie, Rattray, Alyth, and Coupar Angus, east of Old Rattray. The ground acquired for the hospital extends to 2½ acres. The hospital is to be placed facing in such a way as will give the windows of each pavilion (there will be two pavilions) an exposure to the south by east and north by west. The administrative block is placed behind the fever pavilion. The laundry block is about 90 ft. from the nearest fever pavilion. The administrative block will contain a doctor's room, with drug store, lavatory, matron's store, kitchen, parlour, and bedroom for caretaker, all on ground floor, together with servants' accommodation, pantry, &c. There are four bedrooms for nurses on the upper floor, also bathroom, &c. Arrangements have been made with Rattray Town Council to get the use of their small portable hospital as an observation ward. The two pavilions will be 70 ft. apart. Both pavilions are exactly alike, and contain two wards, one for males and one for females, each containing four beds, and having an annexe at the end. Between the wards is placed the nurses' duty-room, with other accommodation. The wards are to be heated with special hospital stoves, with open fires, but in addition to the stoves there is to be an open fireplace in each ward. The plaster work is to be finished with Keene's cement, and all the angles, external as well as internal, all rounded over, and there are no cornices. The floors of the bathrooms, &c., are to be laid with concrete. The laundry block consists of ambulance van shed, mortuary, washing-house, laundry, &c. The plans have been drawn by Mr. Lake Falconer, architect, Blairgowrie.

WORKHOUSE, SOUTHMEAD, WESTBURY-ON-TRYM.—A new workhouse has been built for the Barton Regis Board of Guardians at Southmead, Westbury-on-Trym. The site of the new workhouse is not far from the laundry. The buildings are divided into five main blocks, and the architects (Mr. A. P. I. Cotterell, Bristol, and Mr. W. H. Thorpe, Leeds) have designed the building in the English Renaissance style. Block A comprises the boardroom, 26 ft. by 24 ft., and the clerk's offices, with a strongroom and other offices and paupers' waiting-room adjacent. This block is distinct from the workhouse buildings proper, and is situate to the left of the main entrance. A separate entrance is provided for persons having business with the Clerk. Block B consists of the porter's lodge and the male and female tramp wards, providing accommodation for sixteen males and eight females. At the rear of these premises is the stone yard. Block C comprises the master and matron's apartments and accommodation for eighty-two inmates. This section of the workhouse is arranged on the pavilion system. To the rear of the master's rooms there are storerooms and an inmates' dining hall 40 ft. by 26 ft. Provision is made for the women inmates on the right side of Block C, and for the men inmates on the other side. Quarters are also supplied in this section for two married couples, and at the rear there are the laundry, carpenters' and shoemakers' shops, and a boiler house. In devising Block C on the pavilion type, it was felt that such an arrangement would give facilities for better classification, as compared with the old-fashioned workhouse arrangements. The inmates may, accordingly, in each centre be classified in four divisions, and the indiscriminate commingling of all sorts and conditions of people is avoided. The heating here, as in other parts of the workhouse, will be by hot water. The infirmary is comprised in Block D, provision being made for twenty-four patients—twelve male and twelve female. On either side of the corridor there are three wards, which will afford the means of dealing with doubtful cases. Provision is made for the medical men and the nurses, and at the end of the corridor, reached by a covered way, are two rooms for maternity cases. The mortuary and stables are comprised in Block E. A boundary-wall, nearly half a mile in length, surrounds the new workhouse, outside of which is the hospital for infectious cases. No children will be kept at the workhouse. Two cottage homes have been acquired for some of them quite half a mile away from the workhouse, and others will probably be boarded out. The total present accommodation of the new union buildings is for 110 inmates and twenty-four casuals. The work of erecting the buildings was entrusted to Mr. H. A. Forse, of Bristol. The cost of the site was 3,700*l*. The site is 13½ acres in extent, and the outlay for the new premises, furnishing, and machinery, will amount to about 29,000*l*.

BANK, BETHNAL GREEN.—A new building has just been opened at Bethnal Green for the London City and Midland Bank. The new premises are situate at 465 and 467, Bethnal Green-road. The building is 60 ft. in height, and 50 ft. by 50 ft. There are three floors, a portion of which will be utilised as offices. The elevations, both in Bethnal Green-road and Hollybush Gardens, are of granite and Bath stone, while around the parapet runs a stone balustrading. The joinery, externally and internally, is of polished walnut, the floors being of oak and mosaic. The counters, which face both Bethnal Green-road and Hollybush Gardens, are protected with iron grilles. The ground floor is 17 ft. high, and contains the clerks' departments and the manager's offices. Electric light fittings have been installed, and now only await the carrying out of an electrical scheme by the Borough Council, and the laying of the necessary mains, to be utilised. The architect for the building was Mr. T. B. Whinney, Old Jewry, E.C. Messrs. Roome & Co. were the builders, the work being carried out under the personal superintendence of Mr. John Whiter, a partner of the firm. The fireproof floors were laid by the Columbian Fireproof Co., of King William-street, E.C.; and the electric lighting is by the firm of Mr. Chas. Winn, Union-street, Borough.

BUSINESS PREMISES, DARLINGTON. — New premises for Messrs. Todd Bros., drapers and general outfitters, have been erected at Darlington, in Crown-street. Mr. G. G. Hoskins is the architect. The building has a frontage towards the south of about 80 ft., and extending from south to north about the same distance. The lower ground floor is treated with Burmantoft's faience. Electricity has been installed for artificial light.

VESTRY HALL, NORTON.—At a meeting of the Vestry of the parish of Norton, within one of the districts recently added to the city of Sheffield, the ratepayers approved of the erection of a Vestry Hall and offices, in accordance with the plans prepared by Mr. Joseph Norton, architect, of Sheffield, and have authorised the overseers to proceed with the scheme, which, with land and furniture, is estimated to cost about 5,000*l*.

SANITARY AND ENGINEERING NEWS.

WIDNES AND RUNCORN BRIDGE.—The construction and erection of this work has been well advanced during the last six months, and although considerable progress has been made on the site, still more has been made at the contractor's works. On the Runcorn side a large amount of masonry and earthwork, to form the new road approach, has been completed, and most of the large cast-iron cylinders which form the base of the towers have been sunk to the level of the rock, about 25 ft. below the bed of the Manchester Ship Canal. The engineers for the work are Mr. John J. Webster, M.Inst.C.E., of Westminster, and Mr. John T. Wood, of Liverpool, the resident engineer being Mr. L. H. Chase, M.Inst.C.E. The contractors for the steel superstructure are Arrol's Bridge and Roof Co., Glasgow, who have sublet a portion of the girder, tower, and cast work to the Widnes Foundry Co., and the sinking of the tower cylinders to Messrs. Holme & King. The contractors for the masonry and earthwork of the approaches are Messrs. W. Thornton & Son, of Liverpool.

RESERVOIRS, HALIFAX. — The members of the Halifax Corporation visited, on the 10th inst., the new reservoirs at Walshaw Dean. Walshaw Dean is fourteen or fifteen miles from Halifax. The scheme embraces the construction of three reservoirs, the combined capacity of which will be 640 million gallons. Messrs. G. H. Hill & Son, Manchester, are the engineers, and Mr. Enoch Tempest, of the same city, is the contractor. The total cost will exceed 200,000*l*. The drainage area is 2,300 acres, and the completion of the scheme will give an additional daily supply of 2½ million gallons, after allowing 1½ million gallons per day for the compensation water which the Corporation are obliged to send down the brooks for the use of millowners and farmers on the stream.

FOREIGN.

FRANCE.—The jury in the annual competition founded by the Société Nationale des Architectes Français has awarded the first prize to M. Parenty. The subject of the competition was "Une Ecole Maternelle à Paris."——The town of Troye (Aube) has opened a competition for a new Hôtel de Ville on a large scale.——A new Hôtel des Postes et Télégraphes is to be built at Clermont.——M. Jean Boucher, the sculptor, has been commissioned to execute the monument to Renan which is to be inaugurated at Tréguier next spring.——The Department of Fine Arts has entrusted to M. de Lasteyrie, of the "Monuments Historiques," and to M. Bonnau, of the Brive district, the direction of the excavations at the church of St. Pierre at Moissac, celebrated for the sculptures over its principal entrance. It is expected that their researches will lead to the discovery of some remains of the church built in 1063.——M. Charles Lucas, the architect, has been appointed for three years a member of the "Comité des Habitations à Bon Marché" in connexion with the Department of the Seine.——The Municipality of Malakoff (Seine) is about to open a competition for the building of a new Mairie.——M. Roussi, architect, has been commissioned to prepare the plans for the new Ecole des Arts et Métiers which is to be built on the Boulevard de l'Hôpital at Paris, at an estimated cost of 6,500,000 francs.——The tower of the church of the Madeleine at Verneuil, remarkable for its sculptural decoration, is to be restored, and has been classed among the "Monuments Historiques."——It is proposed to demolish the fortifications of Lille between the Porte d'Yares and the Porte Louis XIV.——The death is announced of a young sculptor, M. Guittet, at the age of thirty. He was believed to have a brilliant future before him; he had received an honourable mention in 1896, a second medal in 1897, and a travelling studentship in 1899. He also received a bronze medal in the 1900 Exhibition. The museum at Amiens possesses three excellent works by him. M. Guittet was a pupil of M. Roulleau.——The death is also announced of M. Paul Liot, landscape painter, whose Brittany scenes were well known at the Salon exhibitions. He was

a pupil of M. Guillemet, and held the official post of Painter to the Ministère de Marine (equivalent to the Admiralty in England).

INDIA.—Borings recently executed in Vizagapatam Harbour shows that a deep navigable channel, about 300 ft. in width, can easily be dredged. The borings, in which the Government of India is much interested, were carried out in the creek and backwater, and taken down to 30 ft. below low water spring tides.——The Calcutta Commissioners have decided to obtain from England a qualified architect and building surveyor to supervise works for the Corporation. *Indian Engineering*, in commenting upon this, remarks: "We shall look forward with interest to this selection, and to seeing an architect established in Calcutta who will exercise his influence on the building operations that are always proceeding on an extensive scale."——The erection of large barracks at Monkey Point, Rangoon, has been sanctioned.——The new Government telegraph office at Poona has been completed.

MISCELLANEOUS.

PROFESSIONAL AND BUSINESS ANNOUNCEMENT.—Mr. T. M. Rickman, surveyor, 8, Montague-street, Russell-square, has taken into partnership Mr. E. J. Burr, who has been his assistant in his business for many years; and the practice will be carried on at the above address under the style of "Rickman & Burr."

LOCAL IMPROVEMENTS.—The Earl of Carrington has arranged with his trustees to grant to the Corporation of High Wycombe a site in Queen Victoria-road for the proposed municipal buildings. The lease will be for ninety-nine years at a ground rent of 20*l.* per annum, on condition that at least 2,000*l.* is expended upon the fabric. Lord Carrington is disabled from carrying out his wish to make a free gift of the land, which is valued at 950*l.*, but surrenders his life interest therein for a nominal charge of 1*s.* yearly, and will contribute 100*l.* to the purchase fund.—The South Shields Corporation have formulated an extensive scheme for street improvements to involve an estimated outlay of 100,000*l.*, as a part of their new tramways undertaking. The project comprises the laying out of a 60 ft. roadway in Fowler-street, to extend from Thomas-street to King-street, and the acquisition, under their Act of 1900, of all the property not hitherto taken on the line of the new street.—The Corporation of Birmingham will take measures for widening Dale End, in the old part of the city, and Vauxhall-road, and for facilitating the traffic between Saltley, Sparkbrook, and Small Heath by means of a road from Victoria-street to Muntz-street. They intend also to widen the road from the Imperial Arcade to near the junction of Coleshill and Stafford-streets, and to build a bridge at Small Heath on the tender for 22,280*l.* of the Dalziel Bridge and Roof Co. of Glasgow. The Corporation's electrical supply department have accomplished the work, at an outlay of about 9,000*l.*, of converting their system to a higher voltage—from 110 to 220. Increased demands upon the supply necessitated the distribution of a greater current, and the old copper wiring is replaced with a three-wire service covered with bitumen and laid in iron troughs. New lamps capable of resisting the enhanced power, and altered fittings, have been furnished, whilst the expense of generating the doubled power will, it is expected, cost but little beyond that for the lower voltage.—The Sanitary Council lately constituted in Birmingham have appointed a sub-committee to establish a scheme whereby, following the initiative set by Miss Octavia Hill in London, they will assume charge of neglected and crowded property upon lease, collect the rents, and carry out improvements of the dwellings without expending any capital in purchasing the several freeholds.

A PROPOSED CANAL FROM LIVERPOOL TO BIRMINGHAM.—The North Staffordshire Chamber of Commerce are about to invite the co-operation of the Birmingham Chamber in the construction of a canal from the latter city and South Staffordshire, through the potteries district to Liverpool. It is represented that the current railway rates have an adverse effect upon the exportation of iron from South Staffordshire, insomuch so, that traders in the Midlands send their orders for heavy iron work to Belgium. To cite a concrete example in point, the railway rate from Birmingham to Liverpool for bedsteads is 18*s.* 11*d.* per ton, and that for hardware is 20*s.* 2*d.* per ton. Moreover, the similar rates from Hull to Birmingham are much less than those from Birmingham to Hull.

FONT, ST. THOMAS'S CHURCH, SALISBURY.—The Bishop of Salisbury recently dedicated a stone font and ornamental oak cover in St. Thomas's Church, Salisbury, which has been erected as a memorial to the late Rev. William John Birkbeck. The font was designed by Mr. Doran Webb, and the work was entrusted to Messrs. Harry Hems & Sons, of Exeter. Various portions of the supplementary work, including the oak panelling round the baptistry, have been carried out locally. The font is carved from a single block of Beer stone, and is over 1½ tons in weight; it is octagonal in shape, standing upon a double tier of steps of the same material, and on the upper part of each side is a panel carved in relief. The four major panels on the north, west, south, and east sides respectively represent the following Scriptural subjects: The Baptism of our Lord, the Crucifixion, the Burial, the Resurrection. The four minor panels are each composed of a shield, surrounded by a garter, the subjects on the shields being as follows: South-east, the arms of the See (Virgin and Child); south-west, the Ark; north-west, the arms of St. Thomas à Becket; the north-east side panel has the Three Fishes. The canopy measures 6 ft. 6 in. in height above the top of the font; it is carved in old oak, with pinnacles at the base of the spire, which is relieved by the open tracery work on it. The whole is surmounted by a dove with outstretched wings. The complete height of the font and canopy is 11 ft. 6 in. The hanging apparatus by which the canopy is raised was supplied by Messrs. Singer, of Frome.

SWEDISH GRANITE.—According to official reports the exports of granite from Swedish ports to the United Kingdom is annually increasing, and Mr. Consul Duff writes from Gothenburg that exporters are very eager to open transactions with British firms, from whom, they say, they obtain better prices and meet greater promptness in business than from others.

DOLLARS AND POUNDS.—The Fairbanks Co. send us a small pamphlet of tables for converting American dollar currency into pounds sterling, which may be useful to firms having large dealings with the United States. They also give a table for converting French metrical measures and weights into English.

CONSUMPTION OF CEMENT IN THE UNITED STATES.—Mr. Bell, British Commercial Agent in the United States, reports on this subject to the Foreign Office in these terms:—"British cement manufacturers appear to have abandoned this market. During the last fiscal year only 8,674 tons came from the United Kingdom out of a total of 189,216 tons. Belgium sent 74,065 tons, and Germany 101,364 tons." The average declared prices per ton of the imported Portland cement from the different countries were as follows:—

	Dols.
United Kingdom	8·70
Belgium	7·04
Germany	8·23
Average of all countries	7·81

Official statistics give the production of Portland cement for 1901 in the United States as 12,711,225 barrels, an increase of 4,229,205 barrels over that of 1900. It was valued at 12,532,360 dols., as against 9,280,525 dols. in 1900. In 1890 sixteen works produced 335,000 barrels, in 1894 twenty-four works produced 798,000 barrels, in 1899 thirty-six works produced over 5,652,000 barrels, in 1900 fifty works produced over 8,482,000 barrels, in 1901 fifty-six works produced over 12,711,000 barrels, in 1890 each one of the sixteen cement works averaged more than 220,000 barrels, in 1901 each one of the cement works averaged more than 220,000 barrels for the year. The percentage of the consumption of Portland cement has increased from 13·2 in 1891 to 34·7 in 1896, to 73·9 in 1899, to 79·1 in 1891, and to 96·2 in 1901. The total consumption of all kinds of cement in the United States in 1901 was 20,573,538 barrels, valued at 15,786,789 dols. In 1901 sixty works produced 7,084,823 barrels of natural rock cement, valued at 3,056,278 dols., as compared with 8,383,000 barrels produced by sixty-four works in 1900 and with 9,868,000 barrels produced by sixty-three works in 1899. The production of slag cement in 1901 amounted to 272,689 barrels, valued at 198,151 dols., as compared with 365,601 barrels, valued at 274,208 dols. in 1900. Of the total consumption of cement of all kinds in the United States, natural rock cement furnished 71·67 per cent., imported Portland cement 13·54 per cent., and domestic Portland cement 14·79 per cent." In the same report Mr. Bell mentions incidentally that in the past year building operations have been carried on all over the country to an unprecedented extent. This applies equally to residential buildings and factories.

WINDOW, MONK HESLEDEN CHURCH, DURHAM.—At St. John's Church, Monk Hesleden, near Hartlepool, three stained glass windows have just been unveiled. Messrs. Wailes & Strang executed the work, and the same firm carried out the work of the large east window which was unveiled recently.

LEGAL.

THE BUILDING ACT AND FIRE PROTECTION.

MR. H. MCLACHLAN, District Surveyor of the western division of the City, appeared at the Guildhall recently under the following circumstances:—On August 27 last he served upon Messrs. Harrison & Spooner, the builders proposing to carry out certain work at 14, 15, 16, and 17, Holborn-viaduct, a notice of objections to such work, and the builders being dissatisfied with his (Mr. McLachlan's) decision, now appealed against it. Mr. J. P. Grain said this was an appeal from the objections raised to certain alterations which it was proposed to make in the buildings referred to. The Holborn Land Co. proposed to make an opening in the party walls of 14, 15, 16, and 17, Holborn-viaduct, and so make them into one building. Mr. Savill (chief clerk): The whole question resolves itself into this, Is it wholly in one occupation, and is the place adapted for such occupation? Mr. Grain said he should contend that the Holborn Land Company were the sole occupants. The objection raised by Mr. McLachlan was that they were contravening the Building Act, but he thought he should show they were not. Of course, the great point was whether there would be sufficient protection in case of fire. The proposed alterations would establish a central staircase leading up to the flat roof, whereby means of escape would be easy. The fire insurance company by whom the whole of this property was insured approved the alteration and did not increase the premiums. The question of occupation was a very wide one, but he contended that so far as could be the Land Company were the sole occupiers. They had a housekeeper who held the key, and who had to see to the cleaning of the whole premises. Mr. Savill: Do you contend that there is but one occupation? Mr. Grain said he did, and quoted several cases in support of his views, remarking that what the appellants proposed to do in regard to these four houses had been allowed in other buildings by the District Surveyor. Mr. Isitt (secretary of the Holborn Land Company) went into the box, and produced plans. He also explained how the premises were let. The Alderman held that these premises were not wholly in one occupation, nor were they adapted for such, therefore he dismissed the appeal. Mr. McLachlan asked for costs. Mr. Grain said the District Surveyor could hardly do so, seeing he had consented to similar alterations being made elsewhere. Mr. McLachlan said it was distinctly laid down in connexion with the premises where the disastrous fire took place in Queen Victoria-street, that it was not in one occupation, nor fitted for such. Therefore, they could not be too careful. Mr. Savill remarked that the Court had no power to give costs in such a case. Mr. Grain asked the Alderman to state a case. It might be they would appeal. The Alderman: Certainly.

AN ALLEGED DILAPIDATED HOUSE.

THE owner of premises at 20, Warbeck-road, Hammersmith, was recently summoned, before Mr. Rose, at West London, at the instance of the London County Council for allowing the place to remain in a dilapidated condition.

Mr. Collman, who supported the summons, which had been issued under the Building Act, said the object of the proceedings was to improve the character and the appearance of the building. At present the windows were broken and the house had a dilapidated appearance. Neighbours, he added, were consequently inconvenienced.

Mr. Rose: Do you suggest that a man is compelled against his will to clean up his house in order to facilitate the interests of his immediate neighbours.

Mr. Collman: The section of the Act seems to imply that.

Mr. Rose: The words are, no doubt, very broad, but the proposition is a most startling one, and one I have never heard before.

The Council's official described more minutely the condition of the house, and his Worship thought it would be an exaggeration of language to say it was dilapidated.

The summons was adjourned to allow the magistrate to consider the legal aspect.

RECENT PATENTS:

ABSTRACTS OF PATENTED INVENTIONS.

9,923.—A PIPE-WRENCH: *A. F. Jackson and W. W. Whitehead Co.*—A rod having a head and joined to a trigger that is pivoted on to the stem works the movable jaw which is pivoted in a slot cut in the stem. For gripping the work one opens the jaws by pressing the head and the trigger, and closing them with a spring set in the casing.

9,936.—AN ANTI-RUST COMPOSITION: *M. Condron.*—A compound for preserving surfaces of metal is made of pitch, crushed coke or coal, creosote or similar oil, slaked lime, and, it may be, Portland or some other cement.

9,956.—JOINTINGS AND COUPLINGS FOR PIPES: *New Haven Novelty Machine Co.*—In one form a coupling consists of an engaging portion with an externally threaded sleeve, and shoulders that make acute angles with the pipes, which are flanged accordingly. For a valve, and to render a joint either fluid or gas tight without employing solder or packing, the coupling comprises a screwed nut of which the neck fits within the end of the pipe and causes it to expand, and an engaging part that forms the joint.

9,960.—APPLIANCES FOR VENTILATION: *C. L. Pullman.*—Over an opening into the apartment or other confined space is fixed a casing or hood, on to which is pivoted a valve which will exclude a current of air, or may have its flaps set at the front and the back of the hood, and linked to a vane worked by the air. In another form the hood is so pivoted on to arms that it can close one end of the passage, or the hood may be closed at one end, the valve being discarded. A screen mounted upon a shutter is applied to the opening, and on each end of

the shutter is a flange having a pivoted extension-piece.

9,967.—WINDOW FASTENINGS, &C.: *G. W. Johns.*—The sliding stiles and sash stiles are joined together with pivoted plates and slotted plates that are worked with projections and studs to slide upon screws secured to the sash stiles, and can engage with grooves cut in the sliding stiles; the pivot plates on the former stiles will sustain the sash when turned to be horizontal, and will serve for ordinary reversible non-sliding window-sashes.

9,989.—ENGINEERS' SQUARES: *W. Chesterman.*—In order that one may accurately replace a blade in the stock the inventor puts eccentrical washers which engage with recesses in the blade upon fixing-screws; the washers are to be turned so as to bear against the shoulder of the blade before the screws are tightened up.

10,045.—TUNNEL-BORING MACHINES: *A. Farnsworth.*—Means of removing the face are combined with the shield, which has a cutting edge and advancing rams. Screws enable ploughing-cutters to travel along the arms of the revolving cutter-head that are secured to the boss and the rim, the latter being driven by gearing from a motor, and having attached to it front and back plates. Between those plates are other cross plates, either pivoted or fixed, that gather the cut material and lift it to the hopper; on the pivoted plates are stops that will tilt them as they strike against the hopper for discharge of the contents.

10,084.—ARTIFICIAL STONE BLOCKS: *S. E. Boivie.*—For an artificial stone is made an admixture of quartz, slaked lime, slate or quartz sand, and diluted nitric acid. The blocks are treated with steam under high pressure, and are described as being especially fireproof.

10,085, 10,093, and 10,104.—A SPRING-BALANCE FOR SLIDING WINDOW SASHES, AND IMPROVEMENTS IN WINDOW FITTINGS: *F. H. Wallace and A. G. Hilton.*—The ends of a broad spiral spring that is loosely placed within a toothed barrel are hooked for engagement with projections from the barrel and a fixed axle, which is either cast in one piece with the casing or is attached to it. The toothed barrel is set in gear with a rack upon the sash, the lowering of which will wind up the spring; when the spring is unwound the barrel will freely slide in one direction over the outer end of the spring, but a reversal of its motion causes a projection to engage with a hook, otherwise the barrel has three such projections and the axle has two, a pawl being pivoted on to the outer end of the spring. The casing has a detachable part in which is an aperture to take a collar of the barrel. (10,093.) Compensation for warping and shrinkage of the woodwork is afforded by pivoting the box that holds the apparatus already described on to a bolt which is inserted through the lug of a face-plate secured to the frame of the window, a spring that is mounted upon a bolt and presses against blocks of the box also forces the wheel to engage with a rack upon the sash, lugs within the two portions of the box constitute bearings for the latter bolt, and for a rocking shaft of which the cranked arm or pawl engages with the teeth of the wheel so as to lock the sash. A push-rod which is screwed into a block pivoted to another crank on the shaft serves for the working of the shaft, and since the crank will slide upon the shaft and the rod is put through a slot in the side of the box, the swinging movement of the box is provided for. A screw which enters a groove in the shaft prevents the turning of the crank upon the latter. (10,104.) Wooden racks for sashes are cut across the grain, the fibres extending to the front of the teeth from the back of the rack. A central strengthening-bar is let into the back of the rack, or two strips of wood are glued lengthwise in grooves, whilst the solid end of the rack will prevent it from running out of gear with the pinion of the spring.

10,134.—SUPPORTS FOR PIPES, MAINS, &C.: *H. C. Longdon.*—Adjustable supports and brackets, which are also adapted to meet differences in the diameters of the pipes, consist, in one shape, of a serrated base-piece (carried by a plate affixed to the pillar or wall) that will engage with the teeth of a bracket which can be tilted or otherwise moved adjustably by means of the cutting away of the head of the bracket-piece; the opening through which the head of the bracket-piece is inserted may be at the top, and a transverse adjustment is provided by causing the supports to engage with teeth upon the upper surface of the bracket. In another variety the toothed bracket is adapted for a smooth-faced cantilever or support.

10,142.—SIPHONICAL DISCHARGE: *F. Shanks.*—The tank is cast about the outlet leg of the siphon pipe so as to hold it securely; the cover, consisting of two unequally-sized portions, is bolted down, its two parts abut crosswise and have lugs on to which the working lever is pivoted. For a cistern that is placed near the level of the closet, the shorter leg of the siphon is inserted into a vertical starting cylinder containing a piston to be worked by the hand. An inward and upward recess may be substituted for the customary depression that takes the well at the base of the cistern.

10,143.—CONSTRUCTION OF WALLS, CEILINGS, &C.: *Fireproof Plate Wall Co. and C. H. Sidebotham.* Cement or plaster slabs, having recesses, interlocking edges, and perforations for metallic tie rods, are laid diagonally. Rubber strips that are fastened on to plugs with screwed rings, form undercut recesses which take the cement. The ends and sides of the mould are disposed so that they will slide outwards, whereby any distortion of the slabs will be obviated whilst the plaster is becoming set. Both the ends and the sides move outwards together as the plaster expands in the mould. The bevelled tongues of the ends press against recesses fashioned in the side. For a horizontal laying of the slabs, confer Nos. 18,583 of 1893, and 9,108 of 1898.

10,170.—IMPROVEMENTS IN LIFT-VALVES: *G. W. Wallers.*—The inventor devises a socket having an aperture in its side for engagement with the flanged end of the spindle, and a detachable seating which fits over the ring of the diaphragm and is made fast with a screwed collar; the collar has a cap for its cover and openings through its sides.

10,209.—FLUSHING APPARATUS AND WATER DISCHARGE: *H. E. Bullock.*—A stem, having a cone-shaped shoulder, carries a valve which shuts the outlet from the cistern. A sleeve into which it is inserted works through a guide-bar, and a catch is pivoted to lugs upon the sleeve. A ring joins the catch to an arm and float. A spring inside a tube normally forces downwards the lower end of a rod that is also pressed by a projection from the seat of the closet. On the tube are lugs in which is pivoted a lever linked to the upper end of the rod. The sleeve hangs from the outer end of the lever.

10,211.—FLOORINGS AND CEILINGS: *T. O'Shea.*—Flanged plates, of which the ends have notches that take the upper flanges of the girder, are rivetted together cross-wise for bars or joists to carry the floor; angle-iron bars and struts are rivetted on to the plates and forced against the girder flanges. Between the plates are nailed to the joists a set of corrugated metallic sheets and wooden strips for the flooring; concrete or other material is laid over the sheets. The ceiling is sustained with metallic strips wired on to the joists, and having their tongues inserted through slits in metallic sheets and expanded metallic lathing. Tongues underneath the sheets are pierced for pins, and the end of the tongues are turned over beneath the plastered lathing. The sheets serve to exclude water, and the passing of sound, heat, and fire is prevented by the spaces formed between the floor and the ceiling.

10,215.—CASINGS FOR ELECTRICAL CONDUCTORS: *F. H. Golding and C. A. James.*—The middle raised part of the metallic body divides two grooves, and provides a web to take the fixing-screws. The cover is sprung into its place by means of the bowed upper edges of the sides of the body, and the conductors are retained by bridges which fit on to the upper edge or grip the raised middle dividing-piece. Angular casings, jointed to one another and reduced in the direction of the angle for the bending of the conductors supply elbows, which may have spring tongues to grip against the back part of the middle dividing-piece.

10,272.—A BRACKET FOR SPOUTING AND GUTTERS: *T. Ballinger and W. Milligan.*—For gutters or spouting underneath eaves is provided a bracket of galvanised iron, made with a double thickness. A hook is pivoted at its end for retaining the head of the gutter. The feet are turned downwards and upwards, and are secured to the board, one of the feet having a hook beneath which the edge of the gutter is put.

10,297.—MANUFACTURE OF PORTLAND CEMENT: *C. Forell.*—Liquid blast-furnace slag is granulated in water. The mixture is then treated to a fusing or clinkering point with so much of lime as will raise the amount of the latter to a ratio of 50 per cent., and finally cooled and pulverised.

10,310.—A COVERING FOR BOILERS, TANKS, PIPES, and OTHER HEATED FURNACES: *T. Smith.*—The composition contains 35 per cent. of pressed barm, 30 per cent. of fibre, 20 per cent. of fossil meal, 5 per cent. of salt, 5 per cent. of clay, 4 per cent. of tar, and 1 per cent. of lime.

10,334.—BRAKES AND PULLEYS FOR LIFTS AND HOISTS: *A. Giebeler.*—The movements of the hoisting-pulley and a bush that run loosely upon the spindle are restricted through the engagement of their recesses with a key affixed to a collar upon the spindle; the flats of the bush will engage with a slotted piece whereof one end constitutes a brake block; to its other end is pivoted another brake block made in one with a lever linked to a pin upon the hoisting pulley. A fixed brake ring is set in engagement with both brake blocks. When the pulley turns in a direction opposed to that of the driving power, as relaxed, the engagement between a recess and the key causes the pulley to carry the spindle with it, but a greater friction of its bearing causes the bush to remain stationary. The relative movement between the bush and the pulley brings the lever into play for the working of the brake.

10,388.—FLOORS FOR VIADUCTS, BRIDGES, AND SIMILAR PURPOSES: *F. A. Sauer.*—A series of tubular spaces is formed by laying metallic plates one over the other. The plates have angular or curved corrugations which may be filled in with wooden strips, on to which the woodwork of the ceiling and floor can be nailed. The sheets are to be fastened together with bolts, rivets, or tongues punched in them and turned outwards.

10,407.—BUILDING OF WALLS: *W. F. Parker.*—The angles of plastered walls are protected with metallic beads or strips fashioned by the bending of their strips into a flanged and beaded T-shape (in cross section). The beads are fastened in their places with strips of wire netting, or with clips which are slitted so as to form tongues to be turned over the flanges of the beads. Holes made in the webs of the beads take the plaster.

MEETINGS.

SATURDAY, SEPTEMBER 20.

Northern Architectural Association.—An excursion meeting to new buildings in Dean-street and Collingwood-street, Newcastle.

SEPTEMBER 23 TO 26.

National Association of Master House Painters and Decorators.—Newcastle Convention.

WEDNESDAY, SEPTEMBER 24.

Builders' Foremen and Clerks of Works' Institution.—Quarterly meeting of the directors. 8 p.m.

FRIDAY, SEPTEMBER 26.

Sanitary Institute (Lectures for Sanitary Officers).—Dr. E. J. Steegmann on "Mechanical Physics: Laws of Motion, Hydraulics, &c." 7 p.m.

SATURDAY, SEPTEMBER 27.

Incorporated Association of Municipal and County Engineers.—Midland District meeting at West Bromwich.

SOME RECENT SALES OF PROPERTY:

ESTATE EXCHANGE REPORT.

September 2.—By MESSRS. COBB (at Rochester).

Rochester, Kent.—High-st., The Tartar Frigate, p.-h., f., p.	£2,000
Newington, Kent.—Keycol Farm, 21 a. 2 r. 19 p., f.	2,800
Meopham, Kent.—Priesthood Farm, 24 a. 2 r. 8 p., f.	395

September 4.—By DOUGLAS YOUNG & CO. (on estate).

Finchley.—Stanhope-av., six freehold building plots	446
Mountfield-rd., 12 freehold building plots	1,241
Cavendish-av., Pont Nevis, f., y.r. 55*l.*	750

September 5.—By G. B. HILLIARD & SON (at Chelmsford).

Springfield, Essex.—Sanford Mill, with residence, four cottages and 8 a. 1 r. 15 p., f. (as a going concern)	1,450

September 6.—By Messrs. SPELMAN (at Norwich).

Costessey, Norfolk.—The Church Farm Estate, 252 a., f. (in numerous lots)	5,200

By WILLSON & PHILLIPS (at Southend).

Southend, Essex.—Southchurch-rd., f.g.r., 51*l.* 8s., reversion in 77 yrs.	1,250
Boscombe-rd., &c., twenty-three plots of freehold building land (in lots)	1,373

September 8.—By G. B. HILLIARD & SON.

Burnham-on-Crouch, Essex.—Gardner's-lane, two enclosures, 10 a. 0 r. 10 p., f.	2,050
Gardner's-lane, four enclosures of land and foreshore, 47 a. 0 r. 7 p., f.	1,400
Main-st., freehold building site, 0 a. 1 r. 11 p.	900

September 9.—By HAMILTON & MIALL.

Kensington.—29, Sinclair-rd., u.t. 73 yrs., g.r. 15*l.*, y.r. 65*l.*	650

By MORGAN, BAINES, & CLARK.

Croydon.—North End, f.g.r.'s 112*l.* 5s., reversion in 78 yrs.	3,830
Bromley, Kent.—The Broadway, f.g.r.'s 28*l.*, reversion in 81 yrs.	740
Sutton.—Carshalton-rd., f.g.r. 15*l.*, reversion in 56 yrs.	430
Bowes Park.—Queen's-rd., f.g.r. 6*l.*, reversion in 82 yrs.	135
East Ham.—Wortley-rd., f.g.r.'s 8*l.* 10s., reversion in 88 yrs.	225

By RAWLENCE & SQUAREY (at Salisbury).

Rollestone, Wilts.—Enclosures of Down pasture land, 11 a. 3 r. 26 p., f.	130
Shrewton, Wilts.—Three plots of building land, 1 a. 2 r. 21 p., f.	280
Two plots of garden ground, f.	140
Shrewton, Wilts.—Three freehold cottages and 0 a. 1 r. 38 p.	250

September 10.—By J. & W. JOHNSON & CO.

Manor Park.—370 to 380 (even), Sherrard-rd., f., w.r. 198*l.* 18s.	1,800

By DOUGLAS YOUNG & CO.

Bermondsey.—85 and 87, Long-lane (S), f., y.r. 80*l.*	1,775
Kennington.—57, Kennington Oval, y.r. 50*l.*, also i.g.r.'s 25*l.* 10s., u.t. 17 yrs., g.r. 20*l.*	420

September 11.—By W. HALLETT & CO.

Westminster.—29, Caroline-st., u.t. 29 yrs., g.r. 10*l.*, y.r. 35*l.*	200
Chelsea.—88, Westbourne-st., u.t. 18½ yrs., g.r. 5*l.*, y.r. 30*l.*	200

By W. MARTIN & CO.

Dulwich.—45, Lordship-lane, u.t. 64 yrs., g.r. 8*l.*, y.r. 55*l.*	725
51, Oakhurst-grove, u.t. 76 yrs., g.r. 10*l.*, e.r. 42*l.*	360

By C. C. & T. MOORE.

Whitechapel.—Raven-row, The White Lion h.-h., f., y.r. 42*l.*	1,000
Tottenham.—67, West Green-rd. (S), u.t. 74 yrs., g.r. 9*l.*, y.r. 50*l.*	680
Islington.—163 to 169 (odd), Essex-rd., u.t. 16 yrs., g.r. 26*l.*, y.r. 158*l.*	725
Homerton.—43, Mehetabel-rd., u.t. 49¼ yrs., g.r. 2*l.*, w.r. 33*l.* 16s.	345
Mile End.—60 and 64, Mile End-rd. (S), u.t. 27 yrs., g.r. 13*l.*, y.r. 100*l.*	1,030
Hackney.—373, Hackney-rd., and 1, Garner-st., u.t. 13¾ yrs., g.r. 5*l.* 6s., q.r. 58*l.*	230
Poplar.—153, 155, and 157, Brunswick-rd., u.t. 36¾ yrs., g.r. 10*l.* 10s., w.r. 88*l.* 8s.	630
Barnsbury.—70, Albion-gr., u.t. 37 yrs., g.r. 7*l.*, y.r. 38*l.*	315

COMPETITIONS, CONTRACTS AND PUBLIC APPOINTMENTS.

(For some Contracts, &c., still open, but not included in this List, see previous issues.)

COMPETITIONS.

Nature of Work.	By whom Advertised.	Premiums.	Designs to be delivered
*Technical Schools and Free Library	Ramsgate Corporation	50*l.*, 25*l.*, and 15*l.*	Nov. 30

CONTRACTS.

Nature of Work or Materials.	By whom Advertised.	Forms of Tender, &c., supplied by	Tenders to be delivered
Additions to School, Church-street, Hurdsfield		S. J. Aspinwall, 46, Chestergate, Macclesfield	Sep. 23
Waterworks	Hemsworth R.D.C.	J. Scholefield, Hemsworth, near Wakefield	do.
Street Works, &c., Dysart-street	Ashton-under-Lyne Town Council	J. T. Earnshaw, Civil Engineer, Town Hall, Ashton-under-Lyne	do.
Street Works, Penywain-road, &c.	Cardiff Corporation	W. Harpur, Civil Engineer, Town Hall, Cardiff	do.
Stonework, &c., Victoria Buildings	Manchester Corporation	City Architect, Town Hall, Manchester	do.
Additions to Workhouse	Mount Bellew (Ireland) Guardians	R. Halvey, The Workhouse, Mount Bellew	do.
School, Ker-street	Devonport School Board	Hine & Odgers, Architects, Lockyer-street, Plymouth	do.
Electricity Sub-station, Sackville-street	Dublin Corporation	S. Harty, Engineer, City Hall, Dublin	do.
*Wood Fencing and Gates	Willesden District Council	Council's Engineer, Dyne-road, Kilburn, N.W.	do.
Sinking Pit Shafts, Oughterside		J. James, Manor House, Oughterside	Sep. 24
Additions to Burnside, Ilkley		H. Hodgson, Architect, Old Bank Chambers, Bradford	do.
Additions, &c., to Chapel, Etherley, Durham		F. H. Livesey, Architect, Bishop Auckland	do.
Offices, Swinburne-street, Gateshead		J. Bower, Borough Surveyor, Gateshead	do.
Additions, &c., to Auction Mart, Turriff		J. Duncan & Son, Architects, Turriff, Aberdeen	do.
Additions to County Hotel, Ulverston		G. Y. McIntosh, Architect, Cornwallis-street, Barrow	do.
Weigh Office, &c., Teall-street		R. Porter, Surveyor, Town Hall, Wakefield	do.
Mortuary, &c., Milton		G. C. V. Inkpen, Civil Engineer, King's-road, Southsea	do.
Mortuary, Coach House, &c., Cobham		G. E. Bond, Architect, Pier Chambers, Chatham	do.
Steel Bridge, Kingston-on-Hull	Messrs. Case & Co.	T. M. Newell, Engineer, Dock Office, Hull	do.
Timber Wharf, Middlesbrough	Wakefield Corporation	do.	do.
Bridges, Walls, &c., Middleton Junction	Portsmouth Guardians	R. C. Irwin, Hunt's Bank, Manchester	do.
Brick Paving Works, West-street	Strood R.D.C.	A. F. Hardwick, Council Offices, Burgess Hill	do.
Repairs, 44, Norton-road, Hove	N. E. Railway Co.	Mr. Cook, 53, Elm-grove, Hove, Brighton	Sep. 25
Laboratories, &c., Chelmsford	do.	F. Whitmore, Architect, Duke-street, Chelmsford	do.
Flint Road Metal	L. & Y. Railway Co.	T. C. Golder, Borough Surveyor, 23, Queen-street, Deal	do.
Street Works, Kelvin-grove, &c.	Burgess Hill U.D.C.	Borough Engineer, Town Hall, Gateshead	do.
Road Works, Roman-road, &c., Bemerton, Salisbury		Lemon & Blizard, Surveyor, 38, Silver-street, Salisbury	do.
Rebuilding Mermaid Inn, Coventry	Essex County Council	H. W. Chattaway, Architect, Trinity Churchyard, Coventry	do.
Stabling, House, &c., near Birmingham	Deal Corporation	G. H. Jack, Civil Engineer, Albert-road, Aston Manor	do.
Additions to Baths, Argyle-street, South	Gateshead Corporation	C. Brownridge, Civil Engineer, Town Hall, Birkenhead	do.
Additions, &c., to Cottage Homes	Earl of Pembroke	C. Lynam, Architect, Stoke	Sep. 26
Three Houses, Penrhiwceiber, Wales	Messrs. Phillips & Marriott, Ltd.	A. M. Leon, Architect, Cardiff	do.
Street Paving Works, Anstruther Wester, N.B.	Aston Manor U.D.C.	J. Currie, Architect, Elie, N.B.	do.
Granite Setts	Birkenhead Corporation	J. A. Crowther, Engineer, Municipal Offices, Southampton	do.
Stable, &c., at Hospital	Stoke-upon-Trent Guardians	G. E. Bond, Architect, 384, High street, Rochester	do.
Town Hall and Library		Peddie & Brown, Architects, 8, Albyn-place, Edinburgh	do.
Bridge, Rhodes Bank	Southampton Corporation	Kennedy & Jenkin, 17, Victoria-street, S.W.	do.
*New Building, Newgate-street	Rochester &c., Hospital Board	Engineer, Guildhall, E.C.	do.
*Enlargement of Committee Room at Schools, Ashford	Bo'Ness (N.B.) Town Council	F. W. Roper, Architect, 9, Adam-street, Adelphi, W.C.	do.
Swing Bridge	Oldham Corporation	T. Miller, Civil Engineer, 9, Thoroughfare, Ipswich	Sep. 27
Police Station, South Bank, near Middlesbro'	Corporation of London	W. H. Brierley, Architect, 13, Lendal, York	do.
Police Station, &c., Thornaby-on-Tees	West London School District	do.	do.
School Extension	Ipswich Dock Commissioners	The Clerk, Bewicke Schools, Willington Quay, R.S.O.	do.
Steel Tank, &c.	North Riding County Council	A. Graham, Engineer, Gas Offices, Mansfield	do.
Steel Footbridge, Oak-street	do.	R. P. Hirst, Civil Engineer, Town Hall, Southport	do.
*Erection of Turkish Bath, adjoining existing Baths	Wallsend (U.D.) School Board	Borough Engineer, Town Hall, Burton-on-Trent	do.
*Making-up Roads	Mansfield Corporation	Council's Surveyor, Beckenham	Sep. 29
*Additions to Sewage Outfall Works, Appledram	Southport Corporation	Town Clerk, Chichester	do.
*Wood Paving Blocks Navvy Barrows, &c.	Burton-on-Trent Corporation	Town Clerk, Town Hall, Bethnal Green, E.	do.
Additions to Schools, Cwmcarn, Mon.	Beckenham U.D.C.	R. L. Roberts, Architect, Abercarn	do.
School, Normanton-road	Chichester Corporation	A. Macpherson, Architect, Tenant-street, Derby	do.
Additions to Outfall Sewage Works	Bethnal Green Council	J. W. L. Cooper, Town Hall, Chichester	do.
Waterworks, Newlyn, Cornwall	Mynyddislwyn School Board	W. Curnow, Council Offices, Paul	do.
*Construction of Sewers, Upper Holloway	Derby School Board	Borough Engineer, Town Hall, Upper-street, N.	Sep. 30
*Road Making and Paving Works, Tottenham	Chichester Corporation	Architect's Department, 19, Charing Cross-road, S.W.	do.
*Construction of Road Bridge over River, Bowes Park	Paul U.D.C.	Council's Surveyor, Palmer's Green, N.	do.
*Making-up and Paving Campbell-street	Islington Borough Council	Council's Surveyor, Town Hall, Fulham, S.W.	Oct. 1
*New Hospital	London County Council	A. E. Painter, Architect, 43, Lichfield-street, Wolverhampton	Oct. 2
*Supply of London-made Stone-ware Pipes	Southgate U.D.C.	Park's Department, 11, Regent-street, S.W.	Oct. 3
*Laying Main (Waterworks)	Fulham Boro' Council	Albert Latham, Engineer, Municipal Buildings, Margate	Oct. 6
*Permanent Way (for Elec. Traction), Bridge Work, &c.	Wolverhmptn. &c. Hosp. for Women	County Engineer, Middlesex Guildhall, Westminster, S.W.	Oct. 7
*New Offices & buildings for County Surveyor, Hertford	London County Council	County Surveyor, 41, Parliament-street, S.W.	Oct. 8
*New Court House, Harrow	Margate Corporation	County Engineer, Middlesex Guildhall, Westminster, S.W.	Oct. 14
	Middlesex County Council		
	Hertfordshire County Council		
	Middlesex County Council		

PUBLIC APPOINTMENTS.

Nature of Appointment.	By whom Required.	Salary.	Application to be in
*Assistant Inspector for Sewerage Works	South Stoneham R.D.C.	3*l.* 3*s.* per week	Sep. 25
*Chief Building Inspectorship	Municip'ty of George Town, Penang	200*l.*, &c	Sep. 30
*Surveyor & Water Engineer & Surveyor to Burial Brd.	Teignmouth U.D.C.	180*l.*	Oct. 4
*Junior Draughtsmen (Estates and Valuation Dept.)	London County Council	Not stated	No date

Those marked with an asterisk (*) are advertised in this Number *Competitions* p. iv *Contracts*, pp. iv vi. viii & x. *Public Appointments*, xix.

By J. BURMAN ROSEVEAR.

Fulham.—1A, Grimston-rd., u.t. 92 yrs., g.r. 6*l.*, e.r. 45*l.*	£490
77 and 79 Purser's Cross-rd., u.t. 87 yrs., g.r. 12*l.* 12*s.*, e.r. 100*l.*	1 000
117, New King's-rd., f., e.r. 42*l.*	685

By WORSFOLD & HAYWARD (at Dover).

Dover, Kent.—4, Council House-st. (S), f., p.	370
2, Stembrook, f., w.r. 12*l.* 9*s.* 8*d.*	135
48, Seven Star-st., f., y.r. 18*l.*	200
8, Pleasant-row, f., w.r. 14*l.* 6*s.*	115
23, Queen's-gdns., f., w.r. 14*l.* 6*s.*	215

Contractions used in these lists.—F.g.r. for freehold ground-rent; l.g.r. for leasehold ground-rent; i.g.r. for improved ground-rent; g.r. for ground-rent; r. for rent; f. for freehold; c. for copyhold; l. for leasehold; e.r. for estimated rental; w.r. for weekly rental; y.r. for yearly rental; u.t. for unexpired term; p.a. for per annum; yrs. for years; st. for street; rd. for road; sq. for square; pl. for place; ter. for terrace; cres. for crescent; av. for avenue; gdns. for gardens; yd. for yard; gr. for grove.

PRICES CURRENT OF MATERIALS.

*** Our aim in this list is to give, as far as possible, the *average* prices of materials, not necessarily the lowest. Quality and quantity obviously affect prices—a fact which should be remembered by those who make use of this information.

BRICKS, &c.

	£ s. d.		
Hard Stocks	1 13 0	per 1,000	alongside, in river
Rough Stocks and Grizzles	1 10 0	,,	,, ,,
Facing Stocks	2 12 0	,,	,, ,,
Shippers	2 5 0	,,	,, ,,
Flettons	1 3 0	,,	at railway depôt
Red Wire Cuts	1 12 0	,,	,, ,,
Best Fareham Red	3 12 0	,,	,, ,,
Best Red Pressed Ruabon Facing	5 5 0	,,	,, ,,
Best Blue Pressed Staffordshire	4 6 6	,,	,, ,,
Do., Bullnose	4 11 0	,,	,, ,,
Best Stourbridge Fire Bricks	4 2 0	,,	,, ,,

PRICES CURRENT (*Continued*).

BRICKS, &c.

	£ s. d.		
GLAZED BRICKS.			
Best White and Ivory Glazed Stretchers	13 0 0	per 1,000 at	railway depôt.
Headers	12 0 0	,,	,, ,,
Quoins, Bullnose, and Flats	17 0 0	,,	,, ,,
Double Stretchers	19 0 0	,,	,, ,,
Double Headers	16 0 0	,,	,, ,,
One Side and two Ends	19 0 0	,,	,, ,,
Two Sides and one End	20 0 0	,,	,, ,,
Splays, Chamfered, Squints	20 0 0	,,	,, ,,
Best Dipped Salt Glazed Stretchers and Headers	12 0 0	,,	,, ,,
Quoins, Bullnose, and Flats	14 0 0	,,	,, ,,

PRICES CURRENT (*Continued*).

BRICKS, &c.

	£ s. d.	
Double Stretchers	15 0 0	per 1,000 at railway depot.
Double Headers	14 0 0	,, ,, ,,
One Side and two Ends	15 0 0	,, ,, ,,
Two Sides and one End	15 0 0	,, ,, ,,
Splays, Chamfered, Squints	14 0 0	,, ,, ,,
Seconds	Quality	
White and Dipped Salt Glazed	2 0 0	,, less than best.
Thames and Pit Sand	7	0 per yard, delivered.
Thames Ballast	6	0 ,, ,,
Best Portland Cement	31	0 per ton, delivered.
Best Ground Blue Lias Lime	22	0 ,, ,,

NOTE.—The cement or lime is exclusive of the ordinary charge for sacks.

Grey Stone Lime..... 10s. 6d. per yard, delivered.
Stourbridge Fire-clay in sacks, 07s. 0d. per ton at rly. dpt.

STONE.

	s. d.	
Ancaster in blocks	1 11	per ft. cube, deld. rly. depot
Bath ,,	1 7	,, ,,
Farleigh Down Bath	1 8	,, ,,
Beer in blocks	1 6	,, ,,
Grinshill ,,	1 10	,, ,,
Brown Portland in blocks	2 2	,, ,,
Darley Dale in blocks	2 4	,, ,,
Red Corsehill ,,	2 5	,, ,,
Closeburn Red Freestone	2 3	,, ,,
Red Mansfield ,,	2 4	,, ,,
Hard York in blocks	2 10	,, ,,
,, ,, 6 in. sawn both sides landings, to sizes (under 40 ft. sup.)	s. d. 2 8	per ft. super. at rly. depôt.
,, ,, 6 in. Rubbed Ditto	3 0	,, ,,
,, ,, 3 in. sawn both sides slabs (random sizes)	1 3	,, ,,
,, ,, 2 in. self-faced Ditto	0 9½	,, ,,
Hopton Wood (Hard Bed) in blocks	2	3 per ft. cube. deld. rly. depôt
,, ,, ,, 6 in. sawn both sides landings	2	7 per ft. super. deld. rly. depôt.
,, ,, ,, 3 in. do.	1	8½ ,, ,,

SLATES.

in. in.	£ s. d.	
20×10 best blue Bangor	12 0 0	per 1000 of 1200 at ry. dep
,, best seconds ,,	11 10 0	,, ,,
16×8 best ,,	6 17 6	,, ,,
20×10 best blue Portmadoc	11 7 6	,, ,,
16×8 best blue Portmadoc	6 5 0	,, ,,
20×10 best Eureka unfading green	15 0 0	,, ,,
20×12 ,, ,,	16 20 0	,, ,,
18×10 ,, ,,	11 10 0	,, ,,
16×8 ,, ,,	7 10 0	,, ,,
20×10 permanent green	10 10 0	,, ,,
16×8 ,, ,,	6 0 0	,, ,,

TILES.

	s. d.	
Best plain red roofing tiles	41 6	per 1,000, at rly. depôt.
Hip and valley tiles	3 7	per doz. ,, ,,
Best Broseley tiles	48 6	per 1,000 ,, ,,
Hip and valley tiles	4 0	per doz. ,, ,,
Best Ruabon Red, brown or brindled Do. (Edwards)	57 6	per 1,000 ,, ,,
Do. ornamental Do.	60 0	,, ,, ,,
Hip tiles	4 0	per doz. ,, ,,
Valley tiles	3	,, ,, ,,
Best Red or Mottled Staffordshire Do. (Peakes)	50 9	per 1,000 ,, ,,
Hip tiles	4 1	per doz. ,, ,,
Valley tiles	3 8	,, ,, ,,

WOOD.

BUILDING WOOD.—YELLOW.

	At per standard. £ s. d.	£ s. d.
Deals: best 3 in. by 11 in. and 4 in. by 9 in. and 11 in.	14 10 0	16 0 0
Deals: best 3 by 9	13 10 0	15 0 0
Battens: best 2½ in. by 7 in. and 8 in., and 3 in. by 7 in. and 8 in.	10 10 0	11 10 0
Battens: best 2½ by 6 and 3 by 6	0 10 0	less than 7 in. and 8 in.
Deals: seconds	1 0 0	less than best
Battens: seconds	0 10 0	,, ,, ,,
2 in. by 4 in. and 2 in. by 6 in.	8 10 0	9 10 0
2½ by 4½ in. and 2 in by 5 in.	8 0 0	9 0 0
Foreign Sawn Boards— 1 in. by 12 in. by 12 in.	0 10 0	more than battens.
½ in.	1 0 0	,,
Fir timber: Best middling Danzig or Memel (average specification)	At per load of 50 ft. 4 10 0	5 0 0
Seconds	4 5 0	4 10 0
Small timber (8 in. to 10 in.)	3 12 6	3 15 0
Swedish balks	2 15 0	3 0 0
Pitch-pine timber (30 ft.)	3 0 0	3 10 0

JOINERS' WOOD.

	At per standard.	
White Sea: First yellow deals, 3 in. by 11 in.	22 0 0	23 0 0
3 in. by 9 in.	20 0 0	21 0 0
Battens, 2½ in. and 3 in. by 7 in.	16 10 0	18 0 0
Second yellow deals, 3 in. by 11 in.	18 0 0	20 0 0
,, ,, 3 in. by 9 in.	16 10 0	18 10 0
Battens, 2½ in. and 3 in. by 7 in.	13 0 0	14 0 0
Third yellow deals, 3 in. by 11 in. and 9 in.	14 0 0	15 10 0
Battens, 2½ in. and 3 in. by 7 in.	11 10 0	12 10 0
Petersburg: first yellow deals, 3 in. by 11 in.	20 0 0	21 0 0
Do. 3 in. by 9 in.	17 0 0	18 0 0
Battens	13 0 0	14 0 0
Second yellow deals, 3 in. by 11 in.	15 0 0	16 10 0
Do. 3 in. by 9 in.	13 10 0	14 10 0
Battens	11 0 0	12 0 0

PRICES CURRENT (*Continued*).

WOOD.

	At per standard. £ s. d.	£ s. d.
Petersburg— Third yellow deals, 3 in. by 11 in.	12 10 0	13 10 0
Do. 3 in. by 9 in.	12 0 0	13 0 0
Battens	10 0 0	11 0 0
White Sea and Petersburg:— First white deals, 3 in. by 11 in.	14 0 0	15 0 0
,, ,, 3 in. by 9 in.	13 0 0	14 0 0
Battens	11 0 0	12 0 0
Second white deals 3 in. by 11 in.	13 0 0	14 0 0
,, ,, ,, 3 in. by 9 in.	12 0 0	13 0 0
,, ,, ,, battens	9 10 0	10 10 0
Pitch-pine: deals	16 0 0	18 0 0
Under 2 in. thick extra	0 10 1	0 0 0
Yellow Pine—First, regular sizes	32 0 0	33 10 0
Broads (12 in. and up)	2 0 0	more.
Oddments	22 0 0	24 0 0
Seconds, regular sizes	24 10 0	26 10 0
Yellow Pine Oddments	20 0 0	22 0 0
Kauri Pine—Planks, per ft. cube	0 3 6	0 4 6
Dantzig and Stettin Oak Logs— Large, per ft. cube	0 2 6	0 3 0
Small ,, ,,	0 2 3	0 2 6
Wainscot Oak Logs, p r ft. cube	0 5 0	0 5 6
Dry Wainscot Oak, per ft. sup. as inch	0 0 7½	0 0 8
½ in. do. do.	0 0 7	- - -
Dry Mahogany— Honduras, Tabasco, per ft. sup. as inch	0 0 9	0 0 11
Selected, Figury, per ft. sup. as inch	0 1 6	0 2 0
Dry Walnut, American, per ft. sup. as inch	0 0 10	0 1 0
Teak, per load	16 0 0	20 0 0
American Whitewood Planks— Per ft. cube	0 3 0	0 3 6

Prepared Flooring—	Per square.	
1 in. by 7 in. yellow, planed and shot	0 13 0	0 16 6
1 in. by 7 in. yellow, planed and matched	0 13 6	0 17 6
1¼ in. by 7 in. yellow, planed and matched	0 15 0	1 0 0
1 in. by 7 in. white, planed and shot	0 11 0	0 12 6
1 in. by 7 in. white, planed and matched	0 11 6	0 13 6
1¼ in. by 7 in. white, planed and matched	0 13 6	0 15 6

6 in. at 6d. per square less than 7 in.

JOISTS, GIRDERS, &c.

	In London, or delivered Railway Vans, per ton. £ s. d.	£ s. d.
Rolled Steel Joists, ordinary sections	6 5 0	7 5 0
Compound Girders ,, ,,	8 2 6	9 5 0
Angles, Tees and Channels, ordinary sections	7 17 6	8 17 6
Flitch Plates	8 5 0	8 15 0
Cast Iron Columns and Stanchions, including ordinary patterns	7 2 6	8 5 0

METALS.

	Per ton, in London. £ s. d.	£ s. d.
IRON— Common Bars	7 15 0	8 5 0
Staffordshire Crown Bars, good merchant quality	8 5 0	8 15 0
Staffordshire "Marked Bars"	10 10 0	- - -
Mild Steel Bars	9 0 0	9 10 0
Hoop Iron, basis price	9 5 0	9 10 0
,, ,, galvanised	16 0 0	- - -
(* And upwards, according to size and gauge.		
Sheet Iron, Black.— Ordinary sizes to 20 g.	10 0 0	- - -
,, ,, to 24 g.	12 0 0	- - -
,, ,, to 26 g.	12 10 0	- - -
Sheet Iron, Galvanised, flat, ordinary quality.— Ordinary sizes, 6 ft. by 2 ft. to 3 ft. to 20 g.	12 15 0	- - -
,, ,, 22 g. and 24 g.	13 5 0	- - -
,, ,, 26 g.	14 5 0	- - -
Sheet Iron, Galvanised, flat, best quality:— Ordinary sizes to 20 g.	16 0 0	- - -
,, ,, 22 g. and 24 g.	16 10 0	- - -
,, ,, 26 g.	18 0 0	- - -
Galvanised Corrugated Sheets.— Ordinary sizes, 6 ft. to 8 ft. 20 g.	12 15 0	- - -
,, ,, 22 g. and 24 g.	7 5 0	- - -
,, ,, 26 g.	14 5 0	- - -
Best Soft Steel Sheets, 6 ft. by 2 ft. to 3 ft. by 20 g. and thicker	12 0 0	- - -
,, ,, 22 g. and 24 g.	13 0 0	- - -
,, ,, 26 g.	14 5 0	- - -
Cut nails, 3 in. to 6 in. (Under 2 in. usual trade extras.)	9 5 0	9 15 0

LEAD, &c.

	Per ton in London. £ s. d.	£ s. d.
LEAD—Sheet, English, 3 lbs. & up.	13 12 6	- - -
Pipe in coils	14 2 6	- - -
Soil Pipe	16 12 6	- - -
ZINC—Sheet— Vieille Montagne ton	24 5 0	- - -
Silesian	24 0 0	- - -
COPPER— Strong Sheet per lb	0 0 10	- - -
Thin ,,	0 0 11	- - -
Copper nails ,,	0 0 12	- - -
BRASS— Strong Sheet ,,	0 0 9	- - -
Thin ,,	0 0 10	- - -
TIN—English Ingots ,,	0 1 3½	-
SOLDER—Plumbers' ,,	0 0 6½	- - -
Tinmen's ,,	0 0 8½	- - -
Blowpipe ,,	0 0 9½	- - -

PRICES CURRENT (*Continued*).

ENGLISH SHEET GLASS IN CRATES.

15 oz. thirds	2½d.	per ft. delivered.
,, fourths	2d.	,, ,,
21 oz. thirds	3½d.	,, ,,
,, fourths	3d.	,, ,,
26 oz. thirds	4½d.	,, ,,
,, fourths	3½d.	,, ,,
32 oz. thirds	5½d.	,, ,,
,, fourths	4½d.	,, ,,
Fluted sheet, 15 oz.	3d.	,, ,,
,, 21 ,,	4d.	,, ,,
¼ Hartley's Rolled Plate	1½d.	,, ,,
⅜ ,, ,, ,,	2½d.	,, ,,
½ ,, ,, ,,	2½d.	,, ,,

OILS, &c.

		£ s. d.
Raw Linseed Oil in pipes or barrels	per gallon	0 2 8
,, ,, ,, in drums	,,	0 2 11
Boiled ,, ,, in pipes or barrels	,,	0 2 10
,, ,, ,, in drums	,,	0 3 1
Turpentine, in barrels	,,	0 2 10
,, in drums	,,	0 3 0
Genuine Ground English White Lead	per ton	21 0 0
Red Lead, Dry	,,	20 0 0
Best Linseed Oil Putty	per cwt.	0 1 6
Stockholm Tar	per barrel	1 12 0

VARNISHES, &c. Per gallon.

	£ s. d.
Fine Pale Oak Varnish	0 8 0
Pale Copal Oak	0 10 6
Superfine Pale Elastic Oak	0 12 6
Fine Extra Hard Church Oak	0 10 6
Superfine Hard-drying Oak, for Seats of Churches	0 14 0
Fine Elastic Carriage	0 12 6
Superfine Pale Elastic Carriage	0 16 0
Fine Pale Maple	0 16 0
Finest Pale Durable Copal	0 18 0
Superfine Pale Copal Body	1 4 0
Extra Pale French Oil	1 1 0
Eggshell Flatting Varnish	0 18 0
White Copal Enamel	1 4 0
Extra Pale Paper	0 18 0
Best Japan Gold Size	0 10 6
Best Black Japan	0 16 0
Oak and Mahogany Stain	0 9 0
Brunswick Black	0 8 6
Berlin Black	0 16 0
Knotting	0 10 0
French and Brush Polish	0 16 0

TO CORRESPONDENTS.

J. R. (Amounts should have been stated.)

NOTE.—The responsibility of signed articles, letters, and papers read at meetings rests, of course, with the authors.

We cannot undertake to return rejected communications.

Letters or communications (beyond mere news items) which have been duplicated for other journals are NOT DESIRED.

All communications must be authenticated by the name and address of the sender, whether for publication or not. No notice can be taken of anonymous communications.

We are compelled to decline pointing out books and giving addresses.

Any commission to a contributor to write an article is given subject to the approval of the article, when written, by the Editor, who retains the right to reject it if unsatisfactory. The receipt by the author of a proof of an article in type does not necessarily imply its acceptance.

All communications regarding literary and artistic matters should be addressed to THE EDITOR; those relating to advertisements and other exclusively business matters should be addressed to THE PUBLISHER, and *not* to the Editor.

TENDERS.

[Communications for insertion under this heading should be addressed to "The Editor," and must reach us *not later than 10 a.m. on Thursdays*. N.B.—We cannot publish Tenders unless authenticated either by the architect or the building-owner; and we cannot publish announcements of Tenders accepted unless the amount of the Tender is given, nor any list in which the lowest Tender is under 100*l.*, unless in some exceptional cases and for special reasons.]

* Denotes *accepted*. † Denotes *provisionally accepted*.

BISHOP AUCKLAND.—For the erection of an inn, Woodham, for Sir Wm. Eden, Bart. Mr. F. H. Livesey, architect, Bishop Auckland:—

A. Johnston	£1939 14 0
S. Gladwin	1,142 14 7
G. W. Lazenby	£1,028 1 0
P. C. Scott, Aycliffe*	901 15 5

Painting and Glazing.

Nelson & Taylor	£46 7 7½
M. Johnston	£33 12 11

Joinery and Carpentry.

J. Spaven	£454 5 0
A. Brown	415 10 7
W. Hope	£353 15 0

Slating.

J. & R. Mascall £93 3 0

Plastering.

Sowerby	£139 15 6
S. Kirby	£145 14 6

Plumbing.

E. Thompson	£34 19 0
W. Kilburn	£35 17 6

[*See also next page.*

BRISTOL.—Alterations to business premises, 163 Ashley-road, Bristol, for Mr. W. Jenner. Mr. T. J. Moss Flower, architect, 28, Baldwin-street, Bristol :—
Denby & Co.* £910

DENNY (N.B.).—For additions, &c., to buildings, for the Co-operative Society. Mr. J. Strang, architect, Vicar-street, Falkirk :—
Masonry.—J. B. Abercombie.
Joinery.—J. & P. Dewar.
Ovens for Bakery.—I. J. & P. McLachlan.
Plumbing and Gasfitting.—J. Hunter & Sons.
Plastering and Cementing.—J. Millar.
Slating.—Drummond & Crowe.
Tiling.—Wilson & Wood.
[Estimated cost of buildings .... £2,200.]

DEVONPORT.—For the erection of boundary walls, &c., at cemetery, North Prospect, for the Town Council. Mr. J. F. Burns, Borough Surveyor, Municipal Offices, Ker-street, Devonport :—

W. J. Stevenson	£2,018 0 0	Pearce Bros.	£1,886 8 0
F. J. Stanbury	2,013 0 0	Matchem & Co.,	
Steer & Pearce	1,998 11 1	Ltd.	1,780 0 0
Jenkin & Son	1,989 0 0	H. J. Allen, St.	
A. U. Coles	1,976 18 11	Budeaux*	1,667 0 0

DUNSTABLE.—For the supply of granite, for the Town Council. Mr. George Simcox, Borough Surveyor, Town Hall, Dunstable :—

Cliffe Hill Granite.

	Per ton. s. d.
Grimley & Co., Sutton Bridge, near Wisbeach*	11 3

Harthill Granite.

Chas. Abell, near Atherstone*	9 9

Steam-Rolling and Scarifying.

	Per day for rolling. £ s. d.	Per super yard for scarifying. s. d.
Oxfordshire Steam Ploughing Co., Cowley, Oxon.*	1 6 6	3 8

FARNHAM.—For the erection of two cottages, &c., for the Guardians of the Farnham Union. Messrs. Friend & Lloyd, architects, Aldershot :—

W. J. Snuggs	£989 0 0	P. J. Cæsar	£910 0 0
W. White	979 0 0	A. G. Mardon	895 0 0
H. Fulford	922 8 8		

GATESHEAD.—For building a boundary wall, Saltwell Cemetery, for Gateshead Corporation. Mr. J. Bower, C.E., Town Hall, Gateshead :—

Foundation and Dwarf Wall.

R. & I. Stephenson, Gateshead Low Fell ..... £2 15 0 } per 8-ft. bay.

Coping.

Duncan, Galloway, & Co., Duntrime Quarries, Dundee 0 4 0 } per ft. lineal, 15 by 12.

Wrought-iron Railing.

J. & R. Crimson ..... 0 18 0 lineal yard.

HARTLEY WINTNEY (Hants).—For altering road gradient over Beacon Hill, Ewshot, for the Rural District Council. Mr. J. P. Listerson, surveyor :—

C. Mott	£850	Musselwhite & Son	£529
T. Turner	589	Renningham, Fleet*	519
J. J. Paddington	587		

HEMEL HEMPSTEAD.—For the execution of street works, Charles-street, for the Town Council. Mr. W. R. Locke, Borough Surveyor, Town Hall, Hemel Hempstead :—
H. Williams, Harpenden* (lowest of four tenders) £360
[Borough Surveyor's estimate ..... £400]

KILMARNOCK.—For providing and laying c.i. water-pipes, Hurlford, &c., for the District Committee. Mr. John Sturrock, jun., C.E., 63, King-street, Kilmarnock :—

W. Dow	£601 16 9	W. Murchland	£327 13 8
T. Jack	484 7 2	W. Gebbie	287 12 9
R. Gibson	429 10 3	T. Wylie	254 0 0
J. Calderwood	412 4 3	Archd. Lucas,	
W. Lawson	330 12 11	Hurlford*	243 7 10

LONDON.—For the erection of a block of public baths and washhouses in Mansfield and Laburnum streets, Haggerston, N.E., for the Mayor and Corporation of the Metropolitan Borough of Shoreditch. Mr. Alfred W. S. Cross, architect, 53a, Maddox-street, W. Quantities by Mr. Arthur C. Cross, 17, Old Queen-street, Westminster :—

Stimpson & Co.	£66,000	Chessum & Son	£62,838
Whitehead & Co., Ltd.	64,625	Lawrence & Sons	62,352
J. Greenwood	64,019	A. Porter	62,202
C. Grey Hill	64,000	B. E. Nightingale	62,000
Johnson & Son	63,980	Shillitoe & Sons	62,000
Sabey & Son	63,349	W. Wallis	61,997
Wall & Co.	63,098	Killby & Gayford *	61,233

* Amended tender, £54,922, accepted.

PORTH (Wales).—For the erection of schools, Llwyncelyn. Mr. Jacob Rees, architect, Hillside Cottage, Pentre :—
C. Jenkins & Son, Porth £10,950

TERMS OF SUBSCRIPTION.

"THE BUILDER" (Published Weekly) is supplied DIRECT from the Office to residents in any part of the United Kingdom, at the rate of 19s. per annum (52 numbers) PREPAID. To all parts of Europe, America, Australia, New Zealand, India, China, Ceylon, &c., 26s. per annum. Remittances (payable to DOUGLAS FOURDRINIER) should be addressed to the publisher of "THE BUILDER," Catherine-street, W.C.

SUBSCRIBERS in LONDON and the SUBURBS, by prepaying at the Publishing Office, 19s. per annum (52 numbers) or 4s. 9d. per quarter (13 numbers), can ensure receiving "The Builder," by *Friday Morning's Post.*

W. H. Lascelles & Co.,
121, BUNHILL ROW, LONDON, E.C.
Telephone No. 1365, London Wall.
HIGH-CLASS JOINERY,
LASCELLES' CONCRETE
Architects' Designs are carried out with the greatest care.
CONSERVATORIES,
GREENHOUSES,
WOODEN BUILDINGS,
Bank, Office, & Shop Fittings,
CHURCH BENCHES & PULPITS.
ESTIMATES GIVEN ON APPLICATION.

B. NOWELL & CO.
STONE MERCHANTS & CONTRACTORS.
Chief Office.—*Warwick Road, KENSINGTON.*
Norway, Guernsey, and Leicestershire Granite, Kerb, Pitching, and Yorkshire Stone.
ESTIMATES GIVEN FOR EVERY DESCRIPTION OF ROAD MAKING.

THE BATH STONE FIRMS, Ltd.
BATH.
FOR ALL THE PROVED KINDS OF
BATH STONE.
FLUATE, for Hardening, Waterproofing, and Preserving Building Materials.

HAM HILL STONE.
DOULTING STONE.
The Ham Hill and Doulting Stone Co.
(incorporating the Ham Hill Stone Co. and C. Trask & Son. The Doulting Stone Co.)
Chief Office :—Norton, Stoke-under-Ham, Somerset.
London Agent :—Mr. E. A. Williams, 16, Craven-street, Strand.

Asphalte.—The Seyssel and Metallic Lava Asphalte Company (Mr. H. Glenn), Office, 42, Poultry, E.C.—The best and cheapest materials for damp courses, railway arches, warehouse floors, flat roofs, stables, cow-sheds and milk-rooms, granaries, tun-rooms, and terraces. Asphalte Contractors to the Forth Bridge Co.

SPRAGUE & CO., Ltd.,
LITHOGRAPHERS,
Employ a large and efficient Staff especially for Bills of Quantities, &c.
4 & 5, East Harding-st., Fetter-lane, E.C.

QUANTITIES, &c., LITHOGRAPHED accurately and with despatch. [Telephone No. 634 Westminster.
METCHIM & SON { 8, PRINCES STREET, ST. GEORGE'S ST. WESTMINSTER
"QUANTITY SURVEYORS' DIARY AND TABLES, For 1902, price 6d. post 7d. In leather 1/- Post 1/1.

BEST BATH STONE.
Original Hartham Park Box Ground & Corsham.
EVERY BLOCK BRANDED WITH OUR REGISTERED TRADE MARK.
MARSH, SON, & GIBBS, Ltd.
Chief Office : Box, Wilts.
Branch Office : York Chambers, Bath.
WORKED STONE A SPECIALITY.

PILKINGTON & CO
(ESTABLISHED 1838),
MONUMENT CHAMBERS,
KING WILLIAM STREET, LONDON, E.C.
Telephone No., 2751 Avenue.
Registered Trade Mark.
Polonceau Asphalte.
PATENT ASPHALTE and FELT ROOFING.
ACID-RESISTING ASPHALTE.
WHITE SILICA PAVING.
PYRIMONT SEYSSEL ASPHALTE.

HOT WATER INSTANTLY NIGHT OR DAY
The QUICKEST Method of Heating Water Hot Water Without Kitchen Fire
HOT BATH IN 5 MINUTES
Boiling Water in One Minute Hot Water Service to all Taps through House
Hot Water in Scullery or Kitchen WITHOUT KITCHEN FIRE
EWART'S "LIGHTNING" GEYSER
For GAS or OIL
Always in action at
346 Euston Road London N.W.
ILLUSTRATED CATALOGUE "SECTION 55" POST FREE